RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS, WESTMINSTER, LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

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VOL. XLII., No. 21. FRIDAY, MAY 24, 1907.

The presidents of the Master Mechanics' and Master Car Builders' associations have sent out to members and to the general managers of member roads a joint circular letter urging full representation at the coming conventions at Atlantic City. The acute condition of car shortage which has developed since the last convention makes the work which these associations have accomplished in the standardization of rolling equipment and the creation and enforcement of the rules governing the condition of, and repairs to, freight cars for the interchange of traffic, assume special and peculiar importance. When every car is needed as badly as at present the prompt movement of equipment under the rules of interchange, and the prompt administration of repairs thereto as provided for in the M. C. B. code, are of more than usual moment. The demands on the motive power departments are also more pressing than ever before. The good to the railroads which always results from the coming together of the men in charge of these departments should be proportionately greater under conditions such as those of 1907. Every road should be represented at the conventions.

We print in another column a letter from M. da Silva Freire, Locomotive Superintendent of the Central of Brazil. He visited the Railway Congress and was so impressed with the possibilities of the Mallet compound that he has just ordered several for his own hilly road. They are small ones, but they are expected to give him the needful power, better adjusted to the weight limitations of his bridges, than, say, a consolidation locomotive of the same weight would be. The Mallet compounds seem to be winning golden opinions for themselves in heavy service on the two roads in this country upon which they have already been used. The pioneer, on the Baltimore & Ohio, has probably attracted more attention than any other engine that has been brought out in recent years, and its economies have been most carefully watched by outsiders, especially those who are apt to be confronted with problems similar to those that led to its construction. This good performance has been supplemented by the work of the engines that were built for the Great Northern, where they have been used in pusher service on the 2.2 per cent. grades over the Cascade range. The coal saving in this case is very remarkable, amounting to 43.8 per cent. and is so much that it probably cannot be entirely attributed to the compound feature when comparing the performance with that of the consolidation locomotive on the same work, but is undoubtedly due, in part, to the more economical working of a large power plant in comparison with a smaller one. The advantages of the design do not stop, however, with mere saving in coal consumption, important as that may be, for the desirability of operating unbroken trains over such ruling grades without too great a multiplication of power units is in itself very important, and the use of the design will probably be continuously extended for especially heavy work. It also has the advantage of affording an available means of extending the wheel base and thus securing a tractive effort where the bridge and track construction are of such a character as to render the concentrated weights of the consolidation engine prohibitive; so that its appearance on such lines that have heavy grades is quite probable, for it appears to be the most efficient design of pushing locomotive that has thus far been brought out.

The Interstate Commerce Commission once more has to report an appalling death list in connection with its accident record. Bulletin No. 22, reprinted in this issue of the *Railroad Gazette*, shows 180 passengers and 294 employees killed in train accidents, this record including the disasters at Atlantic City, Woodville, Lawyer, Enderlin and Terra Cotta. A comparison given in the report shows that this quarter is one of the three most disastrous quarters since the government records were begun, the other two being those ending in December, 1903, and September, 1904. On the occurrence of the collision in the District of Columbia, December 30, the commission began a public investigation of that collision and the one at Lawyer, but the report of this investigation does not appear in the present bulletin, and nothing is said as to when it will appear. Concerning the Woodville collision a report has been published by the State Railroad Commission of Indiana and a notice of this report was given in the *Railroad Gazette* of April 5. The facts of the Lawyer collision have also been authoritatively made public, the Interstate Commerce Commission having been anticipated by the State Corporation Commission of Virginia, which has issued a report of its findings in that case. In Virginia, as in Indiana, the public investigation was satisfactory and intelligent, though the Virginia commissioners, like their brethren in Indiana, supplement their sound conclusions in the case under investigation by some general observations which do them little credit. This Virginia decision is discussed under another head.

The tendency for small railroads to be absorbed by larger systems is particularly noticeable in Canada where, aside from the Intercolonial, the government line, the railroads of the country are coming rapidly into control of three groups, the Canadian Pa-

cific, the Grand Trunk and the Canadian Northern. The most recent instance is the purchase by the Canadian Northern interests of the control of the stock of the Quebec & Lake St. John Railway, a local road in the province of Quebec, hitherto owned and controlled in Quebec and London. This road runs from the city of Quebec across the Laurentian mountains to Roberval on Lake St. John, 188 miles, with a branch from Lake St. John eastward to Chicoutimi, the head of navigation of the river Saguenay, and a branch westward from a point 80 miles northeast of Quebec to La Tuque, a great waterpower at the head of navigation of the St. Maurice river. The road, therefore, commands the trade of much of the northern part of the province of Quebec and the lumber traffic of its two greatest rivers. The Quebec & Lake St. John has, including the new La Tuque branch, 286 miles of substantially built line well equipped with rolling stock, including parlor and sleeping cars which are necessary in order to handle the fishing, hunting and tourist travel. The trip is a most popular one to go from Quebec to Lake St. John by rail thence down the Saguenay and back by the St. Lawrence by steamer, or vice versa, and in summer there is a large passenger travel over the road. Last year 325,000 passengers and 345,000 tons of freight were carried. The forest solitudes in and beyond the Laurentian mountains are being rapidly settled, and already pulp, paper and saw mills and other industries give employment to 10,000 men. The settling of these regions, which is going on at the rate of about 3,000 new settlers a year, is under the control of a colonization department of the company. Already the fertile territory about Lake St. John has an agricultural population of 50,000. The road is also important in its relation to the city of Quebec, which has lost much of its old trade in shipbuilding, timber and shipping. Yet the city is more prosperous than ever, as the outlet for the back country opened by the Quebec & Lake St. John. These are the characteristerics of the road as a local property. It is, however, particularly valuable to the Canadian Northern as a Quebec connection. The Canadian Northern Quebec Railway (the former Great Northern Railway of Canada) runs from Montreal to Riviere a Pierre, on the Quebec & Lake St. John, 57 miles northeast of Quebec. Over the Lake St. John road the Canadian Northern now has its own line all the way from Montreal to Quebec. This is 195 miles long, as compared with 172 miles by the Canadian Pacific, 174 miles by the Grand Trunk and 165 miles by the Intercolonial between those cities. More than this the Quebec and Lake St. John brings to the Canadian Northern interests ownership of a large terminal property covering 400,000 ft. of ground in the heart of the city of Quebec, with deep-water steamship docks having a frontage a quarter of a mile long. It will now be possible for the Canadian Northern, besides using this large terminal property, to have direct connection with the great terminal grain elevator which was built some time ago for the Great Northern of Canada, but with which that road has had no direct connection. The plans of the Mackenzie & Mann interests are believed to include the development of Quebec as an important grain terminal port as soon as the Canadian Northern line is complete from Winnipeg, the central receiving point for the grain of the Canadian northwest, east to Montreal. As the size of ocean steamers increases, the difficulties of navigation of the St. Lawrence above Quebec grow more serious, and the reasons for making Quebec an increasingly important export port grow strongly. Besides its importance to the Canadian Northern as a through connection and important terminal line, it gives that road a most important advantage in the railroad development of the northern part of the province of Quebec which is sure to come before very many years. The Quebec & Lake St. John is already on the ground and is therefore best able to build lines into this rich wilderness. The charter of the road covers the vast country lying between Lake St. John and James Bay, a region as large as France, abounding in spruce forests, water powers and agricultural lands, and with great possibilities of development of mineral deposits.

VIRGINIA COMMISSION REPORT ON LAWYER COLLISION.

The Virginia Corporation Commission has made a report on the collision which occurred at Lawyer, Va., Nov. 29 (*Railroad Gazette*, Dec. 7 and 14), the conclusions of which we will briefly summarize.

The block signal rules were plainly disregarded by the operator at Rangoon. He disobeyed the order requiring him to hold the second train until he had asked for and received "block clear" from the operator at Lawyer. The conductor of the train which was stopped erred in judgment in not cutting out the car with the defective coupling, after having been advised to do so by the car inspector at Lynchburg, and especially as he was delayed by it 45 minutes some distance beyond Lynchburg.

The evidence as to the promptness of the flagman is doubtful, but the commission believes that at best he probably could not have prevented the collision. The second train was running faster than the first and, therefore, as the commission takes care to point out, the flagging rule could not be of value unless a time interval were also maintained at each block station. The commission deferred further comment on the block system pending the publication of the report of the Interstate Commerce Commission on that subject, which had not then been published.

The operator at Lawyer is also criticised, the management of his signal station being declared highly unsatisfactory.

It is found that signalmen exchanged working hours without asking leave to do so and were not required to submit their daily block sheets to any one for inspection. Operators and signalmen have been employed without sufficient experience, and after the slightest and most insufficient examination as to their qualifications.

The train despatcher should have known of the condition of the leading train and should have given instructions to the conductor concerning the car with the defective coupling.

From this point the report goes on to discuss the general management of the operating department of the Southern Railway. The commission finds that the operating staff has been greatly overtaxed. The Danville division consists of 637 miles, too much to be handled by a single officer, however able. Directly flowing from this condition

"we find that the discipline which must obtain on a well regulated railway was conspicuously lacking in several of the operating departments under investigation. It was shown that the operators and signalmen charged with the important duty of directing the movements of trains, were under no immediate supervision; the manner in which they performed their duties was not made the subject of any special inquiry by any officer or superior charged with that immediate responsibility. The method of selection of operators seems to have been loose and unsystematic; the degree of knowledge and experience, not to say skill, of these operators seems not to have engaged the serious attention to which this important question was entitled; nor did the subject of general fitness of these operators, from the standpoint of character and habits, both before and after employment, receive such official attention as the public interest required. The block sheets kept by these operators were not examined from time to time by any supervising agent or officer, an omission which destroyed in a large measure the element of safety which these sheets were intended to provide. It was further shown that these operators were in the habit of exchanging work with each other, resulting in continuous service on the part of one operator for eighteen hours or more, a period beyond the safety limit, which should have been promptly detected and remedied in the ordinary course of business."

The report then takes up the matter of excessive speed and the practice of keeping train crews on duty 40 to 45 hours, and offers a number of sensible criticisms; but all the statements of fact in this part of the report are so general and so vague that it is impossible to judge as to whether the position taken by the commission is or is not well supported by the evidence. It is well said that officers, as well as employees, should be punished when found directly responsible for fatal accidents, but the difficult problem of defining "direct responsibility" where a dozen men are involved is left as much in the air as ever.

But things admitted by officers of the Southern Railway and other things which are commonly known compel the acceptance of most of the commissioners' conclusions as sound; at the same time it is unfortunate that an official report should leave the public to supply for itself such a large part of the information on which any opinion must be based. Besides this, the report is weak in some of its details. The suggestion that a time interval should be maintained so as to make flagging effective only serves to confuse the public mind. No railroad can find much fault with this, for the standard railroad rules, requiring both the space interval and flag protection are calculated to confuse both the public and the commissioners. If the commissioners would denounce such confusing rules they could then pursue a logical course; but in recognizing them they join the railroads in an impossible task. With long time-intervals, flagging *might* be made useful; but in that case a part of the benefit of the block system is wasted. To get its full benefit short time intervals must be provided for; but short time intervals and the flagging system cannot be made to "consist" with each other.

The requirement that a despatcher shall tell a conductor how to deal with a defective car is also based on a very shaky principle. It is worthy to go with the New York commissioners' dictum that the despatcher shall control the lever movements at a dozen interlocking towers. It is well enough for conductors, if they so desire, to ask advice of a despatcher—if he is anything more than

a telegraph operator—but what can a state officer be thinking of to recognize as competent for his duties a passenger conductor who, with a car before his eyes, knows less about its safety than a despatcher who is 10 or 100 miles away? In matters of convenience and expediency, especially as related to the needs of other trains, the despatcher may, indeed, have something to say about the management of a train; but so far as the safety of the cars is concerned the conductor's authority must be absolute—until some one arrives on the spot who knows more than he does.

But, as already intimated, these weak spots in the report are overshadowed by the strong ones. The condemnation of excessive working hours on freight trains and of the excessive size of division superintendents' territories, deserves particular notice. The evil of long hours is already well known, but this and other state railroad commissions ought to make it more thoroughly and more widely known. It is an elusive evil, difficult to reach and expose, for reasons familiar to all. Errors and neglects due to physical or mental weariness are perhaps in a majority of cases not proved; the claim that weariness was not the trouble can be put forward with boldness and confidence. And yet everybody knows that, with men's minds and consciences as they are, rigid time-limit rules are necessary to safe train-working.

Superintendents with too many miles to look after are common all over the country. The Southern Railway has made hopeful improvement in this feature but there is room for much more of this—as there is on most roads. The Southern has done a wise thing in reducing the size of freight solicitors' districts—provided it has taken care not to reduce the size of the *men* who do this work—but it is proper to observe that a traveling freight agent cannot take the place of a traveling superintendent. The customers of a railroad—as well as the employees—always want to deal with a high officer, and it is good business sense, on an extensive railroad system, to fill the division office with a man strong enough—and clothed with enough authority—to be recognized as "high."

THE HARMET PROCESS.

It is too much to expect immediate results from the present far-reaching protest against the methods of the steel rail makers in their efforts to produce maximum tonnage at maximum profit. But it is inevitable that some radical improvements in these methods must be made in the near future. If better methods of rolling will not bring about the desired results and open hearth melting will, then the Bessemer furnaces in the rail mills must be abandoned or turned into another channel of production. If 30 per cent. cropping of the ingot is necessary instead of the 10 or 15 per cent. now cut off, the loss must be pocketed or made up in increased prices. These changes will not be made in a day or a year, and meanwhile the bad rails now in track will continue to break and more bad rails will continue to be laid down. The railroads cannot stop buying rails altogether to enforce their demands; they can only appeal to the cupidity of the rail makers by offering better prices for better rails. The oppression of the trust is food for other thought and somewhat beside the point now. What is wanted is a better rail, almost regardless of cost.

In another column in this issue is a description of a French method of improving the quality of ingots, which seems to offer a solution for overcoming two of the most dangerous defects in steel: piping and segregation. The information on which the article is based was obtained from the Ordnance Department of the United States Army and is, we think, impartial and reliable. Ordnance officers are constantly in search of metallurgical processes which will produce metal of high resistance and uniform quality, and no more conservative or careful body of men can be found. A bursting gun endangers the lives of a gun crew, six to ten men; but a broken rail endangers the lives of a whole trainload of passengers. Surely the need for the best material at almost any cost is as great in railroad work as it is in the army and navy!

There are, of course, difficulties in applying this process to commercial production on the enormous scale demanded in rail mills which do not enter into the production of ingots on a comparatively small scale for ordnance and other special uses. It requires ten minutes to compress each ingot, and the cost is considerable, although we have no definite information on this point. In a rail mill the production is almost continuous, and it would require not less than five presses to supply a single mill. On the other hand there is, or should be, a saving of nearly 25 per cent. in the crop ends. The French government requires 28 per cent. crop in uncompressed ingots and only 5 per cent. on compressed ingots. The letters printed last week were almost unanimous in demanding from 25 to 30 per cent. crop. This saving is even greater than it seems, for it costs much more to remelt crop ends than it costs to handle a corresponding amount of metal from the blast furnace to the ingot mold in the continuous process where the molten iron never cools from one operation to the other. There is also the great advantage of preliminary working of the ingot before passing to the rolls. The small shrinkage cracks which are incipient causes of broken rails are never completely welded in the rolling process. In the Harmet wire drawing process they are not allowed to develop in the ingot.

We are convinced that this process, as yet unknown in the United States, is well worth careful investigation. It is only one of the improvements which might be applied to advantage in rail making. High phosphorus Bessemer steel is another cause which must be carefully investigated and perhaps abandoned for steel made by the open hearth process. A redesigned section for heavy rails is almost equally imperative if any real progress is to be made. In the meantime, determined demands for rails rolled to the best available specifications will do much to remedy the worst phases of a situation which is little short of criminal.

Just as the Government Accident Bulletin comes out, with the official details of the Woodville (Ind.) collision (November, 1906), we have the news that Engineman Galnour, who neglected to assure himself that the freight train had notice that a second passenger train was to follow, has been tried and acquitted of the charge of manslaughter; and this on the ground, apparently, that his neglect to whistle, or his neglect to stop when he received no whistle-signal from the freight, was an error such as any prudent and careful engineman might commit, and therefore not the kind of negligence that constitutes manslaughter. This is a miscarriage of justice, but it is not easy at this distance to see just where the trouble is. As we understand the law of Indiana, as interpreted by the Supreme Court of the state, such plain neglect of duty, with no mitigating circumstances shown, constitutes manslaughter. The minimum punishment is two years in state's prison. Possibly the severity of the required punishment led the jury to acquit, but an acquittal certainly seems to violate the letter of the law, and also its spirit, if we can trust the legislature, which fixed the two-year minimum, to rightly interpret its spirit. The reason why we are unable to decide as to the responsibility for this miscarriage of justice is that the charge to the jury, section 13, given in the footnote,* is confusing. It seems to conflict with the statute. If the jurymen could get no simpler instruction than that, they were, perhaps, justified in acquitting the engineman for lack of information as to the meaning of the law. We cannot take the space to analyze this charge, but the reader probably will not ask us to. Its surprising character is perhaps most strikingly shown in the clause, which seems to declare that if an engineman has many and complicated duties the fact may excuse manslaughter! There is one way of looking at this verdict in which it may perhaps be called rational. The jury decided, in effect, that Galnour was exercising ordinary care. As errors of this kind have been occurring with distressing regularity for the past forty years, it will possibly be well if we all accept the view taken by this judge and these jurymen, that only by extraordinary care—that is, an unattainable degree of care—can such rules be satisfactorily carried out. Accepting this we must abolish the rules and adopt the block system.

NEW PUBLICATIONS.

The Engineering Index Annual for 1906; compiled from the Engineering Index, published monthly in the *Engineering Magazine*, New York and London. The *Engineering Magazine*. 412 pages, 6½ in. x 9¼ in. Price $2, cloth.

This is an index of articles of interest to the railroad man and the engineer which have appeared in the technical papers of this country and Europe during the year 1906. Up to 1906 there have been

*Every omission—that is, failure to discharge a duty—is not necessarily a negligent omission or failure, though you may find that the defendant omitted or failed to discharge some duty put upon him as alleged; and if you further find that such failure or omission was not on account of carelessness, recklessness, or inattention to business, or neglect, then I charge you, while the state may have proved that he was guilty of such omission or failure, yet such proof, without proof of negligence, would be insufficient upon which to base a verdict of guilty.

In considering the question as to whether or not the defendant was guilty of neglect of duty, as charged in some one of the paragraphs or counts of the affidavit against him, you may consider as to what all his duties were with reference to running the train he is charged in the affidavit with running. And in passing upon the question as to whether or not the defendant was guilty of such negligence you may consider what duties he had to discharge in running the train in question on the night and morning alleged; whether they were few and simple, or many and important; and if he omitted or failed to discharge one of his duties, whereby the death of John Doe occurred as alleged in the affidavit, whether such omission or failure was one that other reasonably prudent and careful engineers, placed in a like situation, in the exercise of ordinary care commensurate with the conditions and surroundings, might have omitted or failed to have performed under the same or similar circumstances; if so, then I charge you, if you find that there was an omission or failure to perform, but which was not due to the failure of the defendant to exercise ordinary care in running his engine past train No. 98, as alleged in the affidavit, you should return a verdict for the defendant.

four volumes issued in a similar series of which the first, edited and published by the Association of Engineering Societies, under the direction of Professor J. B. Johnson, covered the years 1884 to 1891 inclusive; the second, from 1892 to 1895 inclusive; the third, from 1896 to 1900 inclusive, and the fourth, from 1901 to 1905 inclusive. Beginning with 1906, instead of publishing such a volume every five years, the publication of annual indexes, of which this is the first, has been begun. This index is a summary of similar records of current technical literature which appear month by month in the *Engineering Magazine*. Instead of being classified alphabetically as has been done in the past, subjects are classified in the present volume under the following divisions: Civil, Electrical, Mechanical, Marine and Naval, and Railway Engineering, Street and Electric Railways and Industrial Economy. These large groups are subdivided according to special divisions of each field. There are 250 technical and engineering journals indexed, about one-fourth of which are in one of five foreign languages. A brief abstract of each article is given showing its scope and purpose, as well as the approximate number of words it contains. The field covered is a broad one, centering about the engineering professions, but including many articles of general interest to engineers. The index is invaluable to anyone who wishes a compact and convenient record of the more important engineering articles of the year. It would, in fact, be most difficult to get such information without it. As an annual publication it should be of very much greater value than before, for it thus represents current practice instead of including much obsolete material.

The Steam Engine and Other Heat Motion. By W. H. P. Creighton, U. S. N. (retired), Professor of Mechanical Engineering, Tulane University. John Wiley & Sons.

When an observant student, a teacher of engineering of more than 20 years experience, undertakes the task of preparing a text book, the resulting volume cannot fail to attract attention. The Steam Engine, by Lieut. Creighton, recently published by Messrs. John Wiley & Sons, is such a volume. When compared with well-known texts dealing with this subject it appears as a distinct type, not that it is necessarily better than others, for that must always remain a matter of personal opinion, but because it has a character which is all its own. First of all, the tendency of American writers has often expressed itself in the appearance of volumes dealing with the steam engine as a machine, and of other volumes dealing with theories underlying its action, while the present work of 500 pages appears as an exponent of the whole field. It is both elementary and advanced. While it describes types of engines, explains the manner of their action and gives practical suggestions concerning their operation, it also deals with thermodynamic principles which the average student approaches with some hesitation. For example, while there are descriptions of valves and valve diagrams, there are also presentations of such thermodynamic subjects as Hirn's analysis and the entropy-temperature diagrams. The range of topics thus introduced required that their treatment be brief, but enough is given to make the book of great value to self-instructed students, and to professors who, in the handling of classes, prefer to reach beyond their text. The first chapter deals with such elementary matters as definitions of work, energy, temperature, horse-power and efficiency; the second, with the steam engine indicator; the third, with work under expansion; and the fourth, with valve diagrams and slide-valve design. These four chapters, making up approximately 100 pages and followed by four other chapters occupying another 100 pages, presenting such principles and applications of thermodynamics as effects of heat, the measurement of the effect of heat on water and steam, heat interchange, and entropy, after which are eight other chapters occupying approximately 200 pages, relating specifically to steam equipment, such as condensers and air-pumps, small auxiliaries, multiple-expansion engines, systems of control, steam engine tests, superheated steam and the steam turbine. These are probably the best portions of the book. The three concluding chapters are upon the gas-engine, gas-producers, boiling in a vacuum, and refrigeration. The chapter upon boiling in a vacuum is evidently drawn from the author's experience in sugar mills work and gives definition to a phase of thermodynamics of great importance in certain portions of our country.

CONTRIBUTIONS

Mallet Compounds in Brazil.

Rio de Janeiro, May 1, 1907.

To the Editor of the Railroad Gazette:

I herewith enclose the table of dimensions of our new Mallet engines, which weigh 208,000 lbs. [See General News Section.] As your Mr. Morris may remember, I got a good idea of this kind of locomotive by riding up the Alleghanies on one, by permission of Mr. Muhlfeld, of the Baltimore & Ohio. We are going to try this type on our mountain districts, where there is a series of 1.8 per cent. grades and 10-degree curves. I suppose that except for a few of these locomotives now in service in the United States, the Central of Brazil is the only road in all America that has ordered any.

J. J. DA SILVA FREIRE,
Loco. Superintendent, Central of Brazil.

Superelevation.

Detroit, Mich., May 19, 1907.

To the Editor of the Railroad Gazette:

The writer trusts that the younger engineers will not be misled as feared by your correspondent in your issue of May 17. He has not forgotten that car wheels have flanges, and that seven out of the eight of them in an eight-wheeled truck are not in contact with the rail head at any specific moment, and are therefore not in service at that moment. The point at issue, so far as the writer is concerned, is whether the lateral friction of car wheels on track rails does or does not neutralize the centripetal force generated by elevating the outer rail three or six or eight inches. The writer uses the term centripetal force with some trepidation since your correspondent has expunged it from the language of the scientific world; but most of your readers will understand it in the ordinary way.

If the outer wheel were a cog wheel and the outer rail a toothed rack so as to ensure longitudinal adhesion such a departure from usual practice would not affect the forces we are now considering; and if such rack and gear were perfectly lubricated so as to give perfect freedom of lateral motion (always limited by the flanges) we should then have the ideal case where superelevation, every inch of it, would exert its full effect to counteract centrifugal force just as is now the commonly accepted practice. If now we clean off the lubricating substance and restore normal conditions re-establishing lateral friction we thereby introduce a change; and that change covers the contention of the writer, viz., that the horizontal effect of superelevation is smothered by the lateral friction and does not relieve the centrifugal force.

JOHN A. FULTON.

Express Rates Ordered Reduced.

The Interstate Commerce Commission has rendered its first opinion in a case involving the reasonableness of an express rate. The Society of American Florists claimed that the rate charged by the United States Express Company on cut flowers from New Jersey points to New York City was excessive. This rate till July, 1906, was 50 cents per 100 lbs., and at that time was raised to $1. The Commission orders it reduced to 60 cents. The express company claimed that the delivery service given cut flowers in New York was much more expensive than that given other articles, and that it could not increase its rate a sufficient amount to meet the expense of this special service without largely increasing the total rate, because of its contracts, under which it is required to pay 45 per cent. of its gross receipts to the railroad companies.

From the opinion of Commissioner Lane it appears that the service rendered by the railroad company is no greater or different under the new rate of $1 than it was under the old rate of 50 cents. The percentage of gross revenue paid by the express company to the Central of New Jersey is 43 per cent., and to the Lehigh Valley 40 per cent. No reason is shown why the railroad charges and agents' commission should be doubled, excepting that the express company has to pay double the amount under its contracts to its agents and to the railroad company—a necessity or condition which the Commission does not recognize as controlling as to rates. An express company cannot justify a rate which, in comparison with other rates, is excessive and unreasonable, by showing that it gives a service that is exceptionally expensive, where the burden of the rate charged therefor, falling upon the shipper, increases an already sufficient return to the railroad. To pay the agent a commission instead of a salary, and to pay the railroad a percentage instead of a fixed amount; or a mileage, or a tonnage, may be, practically, a very satisfactory arrangement between the express company and the railroad and the agent; but such an arrangement cannot be held to support the reasonableness of any rate which the express company may choose to charge. What if the express company had contracted with its agent to pay him 50 per cent. of all gross receipts, or with the railroad to pay it 90 per cent. of such receipts?

Generally speaking, the flowers are delivered at the stations to the express agent and are not collected by express wagons; the producers furnish men to assist the agents of the express company to load the flowers onto the cars; the express agents at points of origin have little, if any, service to perform with respect to most of such shipments, except to make out waybills therefor and to assist in the loading of the boxes onto the cars; the express companies give special care to boxes containing flowers while in transit; the defendant has a special delivery service from the Hoboken station to the delivery points in New York; this service consists of wagons which

carry the flowers from Hoboken to the business places of the consignees; it takes such wagons approximately one hour and a half or two hours to transport the flowers from the train to the commission merchant in New York; such commission merchant consignees are grouped in New York City within three or four blocks of each other; the wagons, teams, and men used in such service in no way differ from those used generally in the express business, and these facilities are used throughout the remainder of the day in such general business; the justification advanced by the defendant for the increase in the rate complained of is that the rate previously existing was not remunerative, owing to the expense of the delivery service in New York City; and the United States Express Company employs agents at the points of origin who are, generally speaking, paid for their services in gathering, billing, loading, unloading, and delivering express matter with a percentage of the gross receipts at such offices, which percentages range downward from 20 per cent. It appears that after the rate was raised in 1902 to 50 cents a wagon express began business in the Chatham district, and has continued therein ever since, carrying flowers produced by that district to New York City at a rate of 60 cents; that such wagon express calls at the greenhouses for the flowers and delivers them from one hour to an hour and a quarter earlier in New York City than the rail express, and delivers the empties at the greenhouses on its return trip; that it is a rule of the defendant that its agents shall call for packages to be carried by it within certain prescribed limits from the agents' offices and shall deliver packages within such limits; that such service has not been given to the shippers of flowers complaining, but that no complaint of this failure to obey the rules of the company was made to any of the general officers thereof; that the general merchandise rate for the Chatham district is one-half that on cut flowers; that the rate on meat and vegetables in corrugated paper boxes is 40 cents per 100 lbs.; dry goods, notions, ice cream, etc., 50 cents; beer, ale, mineral waters, etc., 35 cents; berries, fruits etc., 40 cents; millinery, feathers, hats, and cameras (boxed), Saratoga chips, cigar boxes, doll carriages and straw goods, 50 cents.

Report of the Illinois Railroad and Warehouse Commission.

The Railroad and Warehouse Commission of Illinois, in its report just made to the Governor, advises against participation in the widespread movement among the states to reduce passenger fares by legislative action, at least until careful investigation can be made of the conditions which might be considered to justify such action. The report says:

"There seems to be a popular demand for a reduction in passenger fares, and nearly all the states surrounding us are yielding to this demand. What action should be taken by this Commission with reference to the reduction of passenger rates should be determined by a thorough investigation of existing conditions in this state, entirely uninfluenced by the action taken or proposed in adjoining states. Hasty and ill-advised action cannot but operate to the detriment not only of the railroads of the state, but of the people as well. There seems to be a disposition on the part of some to insist upon the presentation of this question to the legislature at its coming session. In the absence of action by that body it will, of course, become the duty of this Commission to make such investigation and enter such order as the facts elicited shall warrant.

"The railroads in the state of Illinois carried 54,757,396 passengers earning revenue during the year covered by this report [ending June 30, 1906,] which was 1,210,086 more than the preceding year. The average amount received from each passenger was $0.54, being 5 cents less per passenger than during the preceding year. The amount of passenger revenue per mile of road was $2,992 as against $3,176 per mile the preceding year, or a decrease in passenger revenue per mile of road of $184. The average distance haul of each passenger was 27.7 miles, a decrease of five miles from the preceding year, and the average amount per passenger per mile was 1.95 cents.

"The total revenue from the movement of passengers in the state of Illinois during the year ending June 30, 1906, was $29,619,969, which was a decrease from the amount received for the same service in 1905 of $2,241,492. This decrease in the passenger earnings is probably accounted for by the fact of the large increase of electric interurban tracks, which in many cases parallel the existing steam railroads. Many more miles of electric line are in process of construction under like conditions, which will absorb a large amount of short distance travel and must of necessity affect the passenger earnings of the steam roads."

Referring to the reduction in freight rates made by the Commission during the year covered by the report, the latter says: "After a long and exhaustive hearing, the Commission ordered a flat reduction of 20 per cent. on the classes numbered one to five inclusive, that is, merchandise classes, on January 1, 1906, and a graduated scale of reduction on classes six to ten inclusive, and commodity rates, commencing with 10 per cent. on the short mileage, effective July 1, 1906. The reduction of 20 per cent. on the first five classes has been in effect for six months at the date of this report, and the predictions of the railroads that it would be ruinous to their business has not materialized. The number of tons of freight hauled earning revenue for the year ending with the date of this report in the state of Illinois was 146,127,775, which was an increase of 22,543,686 tons over the previous year. The average amount received for each ton of freight was $0.73, against $0.75 the preceding year, or a reduction of only two cents, and the freight earnings per mile of road were $7,880 as against $7,086 the preceding year, or an increase of $794 per mile."

The steam railroad mileage in the state on June 30, 1906, was 11,894 miles, an increase of 257 miles; 2,229 miles of second, third and fourth main track, an increase of 146 miles; 6,005 miles of yard tracks and sidings, an increase of 74 miles, and 416.46 miles of industrial tracks, an increase of 0.92 miles. This last is significant, especially when considered in connection with the letter of Russell Harding to the Interstate Commerce Commission published in the *Railroad Gazette* of January 18, in which he asserted that one of the chief causes of the present car shortage and traffic congestion is the lack of sufficient industrial tracks. The total steam road mileage of the state was 20,544 miles, an increase of 478 miles.

Electric roads had a main line and branch mileage of 936 miles, the increase for the year being 173 miles. The total mileage of electric railways, which includes interurban and elevated roads but not street railways, was 1,187 miles, an increase for the year of 205 miles. The street railways are specifically exempted by law from the jurisdiction of the commission and make no report of any kind to any department of the state government. Concerning this the report says: "It would seem to be just and necessary that a public utility enjoying special privileges by courtesy of the state and municipalities, should be required to submit some kind of a statement of its business to some department of the state government for the information of the people who invest in its securities."

The number of accidents on steam roads from movement of trains was 958 killed and 3,636 injured, an increase over the previous year of 66 killed and 546 injured. From causes other than the above there were 18 killed and 1,563 injured, making the total from all causes 976 killed and 5,189 injured.

The interurban and elevated roads killed 48 and injured 468, an increase of 19 and 23 respectively. These roads carried 183,650,979 passengers, an increase of 21,801,904, and 1,277,566 tons of freight, an increase of 641,823 tons.

Norfolk & Western Improvement Work.

BY GEORGE L. FOWLER,
Associate Editor of the *Railroad Gazette*.

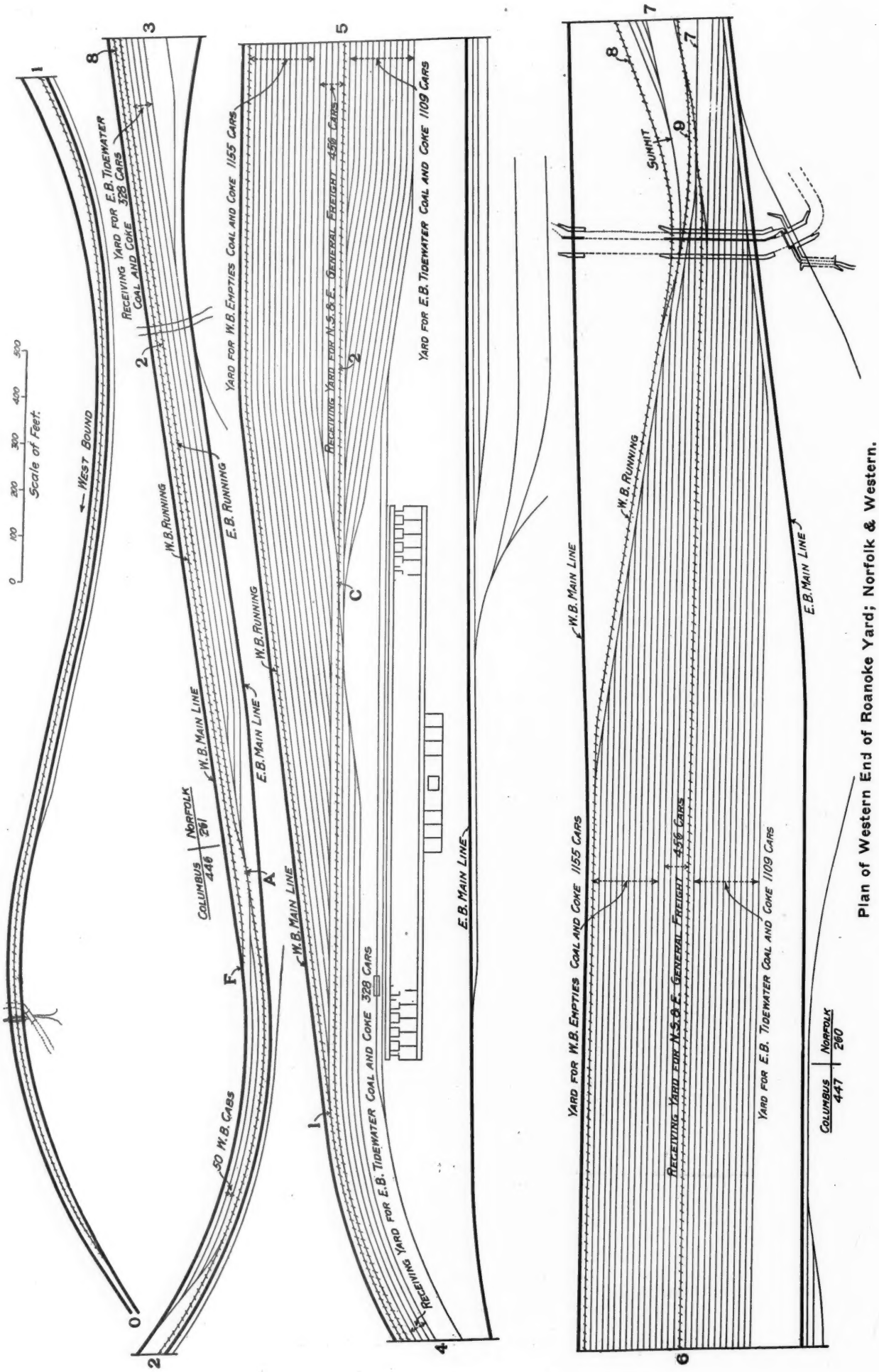
III.

YARDS.

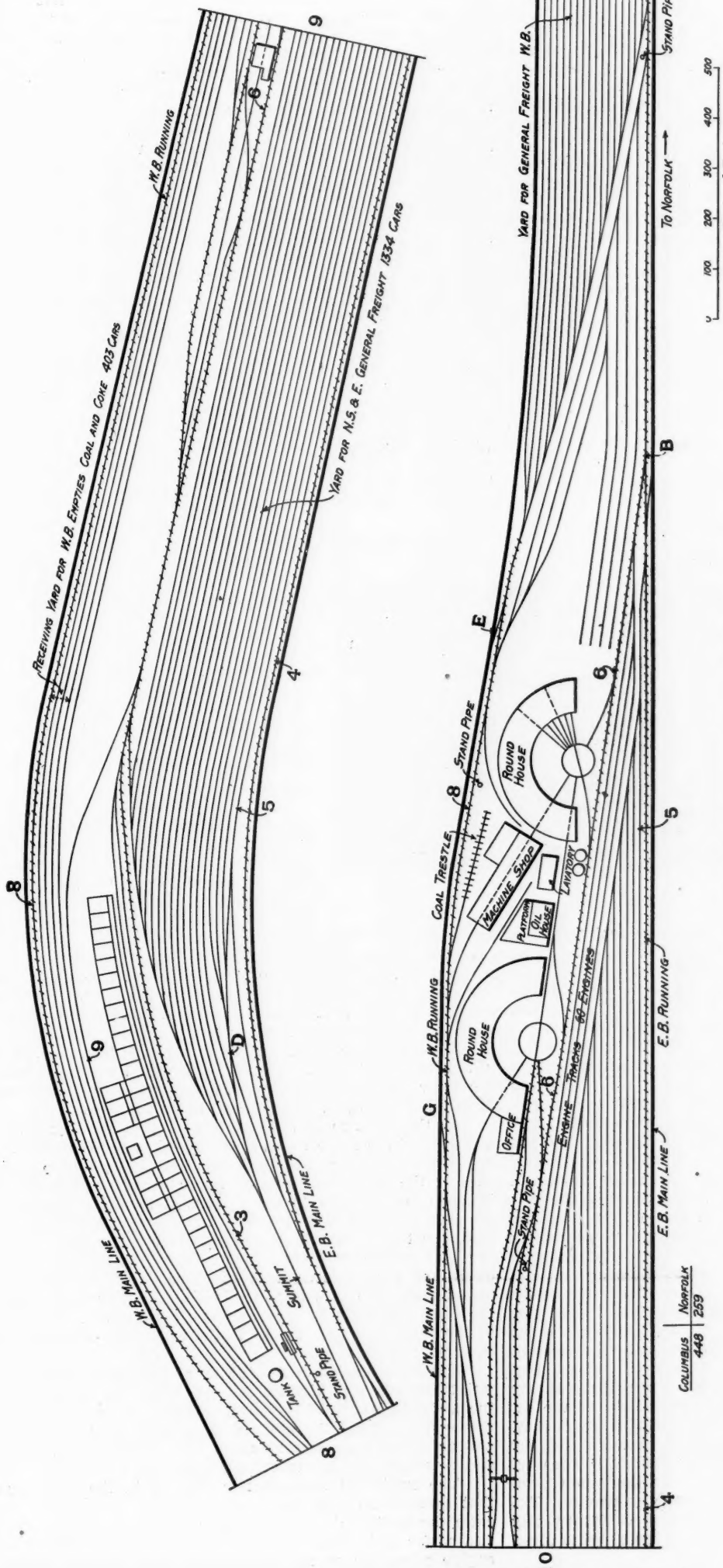
ROANOKE YARD.

Roanoke, Va., is situated at the crossing of the ways. It is the junction point of the main line, extending from tidewater to the mines, and of the north and south divisions running from Hagerstown, Md., to Winston-Salem, N. C. It is not an originating point for any large amount of traffic like Bluefield or Williamson, but it is an important distributing center and the demands are such that a large yard is required. Tidewater coal made up at Bluefield passes through the yard without breaking up, and the new yard has been so designed that this can be done without delay or interference, though the great mass of the general traffic entering from the four points of the compass, and sent out in as many directions, must be reclassified and arranged for distribution. This is, of course, cut down to the lowest possible notch, and there is no general reclassification of either east or westbound coal cars. The empties are sent on to Bluefield for distribution among the several operations, as will be described later, just as the tidewater coal is sent through to the east. Yet with this relief the reclassification of what remains is a large undertaking, for at the present time about 2,500 cars are passed through the yard daily, intended for the four lines running out of Roanoke. To do the work 10 locomotives are kept in service night and day. The yard is not yet entirely completed, but will be finished during the summer months.

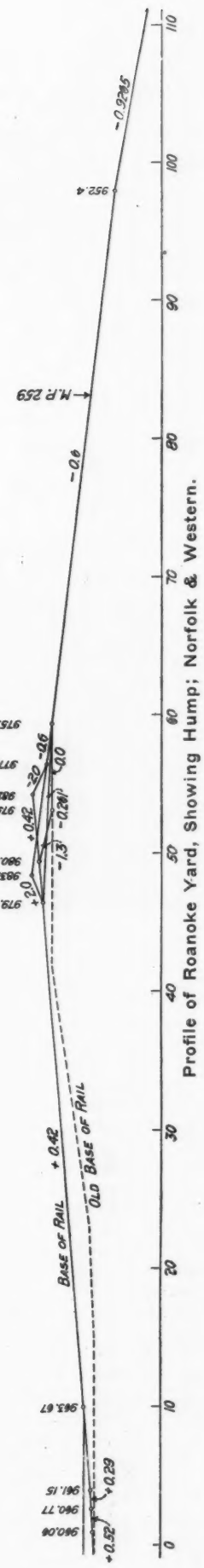
As in the case of the Bluefield and Williamson yards, that at Roanoke has been constructed at great expense and with large quantities of material to be moved. In one place the channel of the Roanoke river had to be changed in order to obtain the necessary width for the tracks and this, with the other excavations needed, run the amount up to 1,385,000 cu. yds., and the cost to $1,240,000. This cost, however, includes a new roundhouse. It is true that the topography of the Roanoke location is not as rugged as it is either at Bluefield or Williamson, still the country is rolling and it has been necessary to level hills of considerable height in order to lay the tracks and, in many places, this leveling has been so accompanied by adjacent filling that when the work has been


Scale of Feet.
0 100 200 300 400 500
WEST BOUND
RECEIVING YARD FOR E.B. TIDEWATER COAL AND COKE 328 CARS
W.B. RUNNING
E.B. RUNNING
YARD FOR W.B. EMPTIES COAL AND COKE 1155 CARS
RECEIVING YARD FOR N.S.&E. GENERAL FREIGHT 456 CARS
YARD FOR E.B. TIDEWATER COAL AND COKE 1109 CARS
W.B. MAIN LINE
E.B. MAIN LINE
COLUMBUS 446 | NORFOLK 261
50 W.B. CABS
RECEIVING YARD FOR E.B. TIDEWATER COAL AND COKE 328 CARS
SUMMIT
YARD FOR W.B. EMPTIES COAL AND COKE 1155 CARS
RECEIVING YARD FOR N.S.&E. GENERAL FREIGHT 456 CARS
YARD FOR E.B. TIDEWATER COAL AND COKE 1109 CARS
COLUMBUS 447 | NORFOLK 260

Plan of Western End of Roanoke Yard; Norfolk & Western.



Plan of Eastern End of Roanoke Yard; Norfolk & Western.



Profile of Roanoke Yard, Showing Hump; Norfolk & Western.

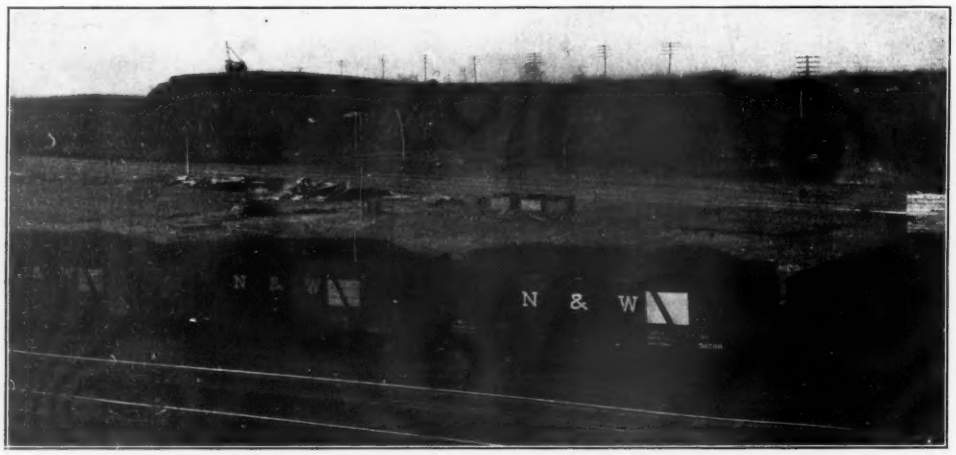
done, there is apparently little to show in corroboration of the figures given for material moved. This yard is, however, nearly all steam shovel work in a hard, shaly sort of clay and sandstone that digs with comparative ease and stands well with little inclination to wash down or slide and fill the ditches.

The yard has a total length of 20,000 ft., is located at the western part of the city, and is the best exemplification of any on the line of the underlying principle of placing the yard between the two main lines of rails. Here it is completely done. The tracks separate at the entrance of the yard and pass along its northern and southern borders, even including the roundhouse and buildings in the swing as at Williamson.

Bearing in mind that the bulk of traffic at Roanoke is eastbound and needs no sorting or classification, we can turn to the physical features of the yard.

As in the case of the westbound traffic at Bluefield, the eastbound freights enter a middle siding that has been cleared for their reception at the west end of the yard and, as this traffic is the most important, the major portion of the yard is devoted to it. These trains then pass over this middle track which, as in the case of all other running tracks, is indicated by a hatched line, until the caboose reaches the point A, where it is cut off and dropped back into one of the tracks reserved for the westbound cabs.

If the train is made up of tidewater coal, it may be run in to one of the three tracks indicated as a receiving yard for that traffic with a capacity of 328 cars, or it may continue on over the running track marked (1) to the yard for eastbound tidewater coal and coke. When the train is left in the first yard the engine is cut off and passes over the running track marked (2) between the yards for general eastbound freight and that for coal and coke to the running track (3) and thence on to the standing tracks or roundhouse.



West End of Roanoke Yard.

If the train is to be sent direct into the tidewater coal and coke yard, it swings away from the receiving yard, and running along the north side of the same, reaches the ladder track at the west end of the main yard. Then, after cutting loose, the engine runs out the east ladder track upon running track (4) and on to the point B whence it backs in to the roundhouse or storage tracks.

Eastbound general freight on reaching the point A swings off directly upon the running track (2) and follows it to the lead of the ladder track of the eastbound freight receiving yard at C, and then swings into that yard. The engine runs out over the eastern ladder upon running track (3) and thence to the roundhouse.

Outgoing tidewater coal and coke, needing no reclassifying, are pulled out of the yard upon running track (4) which they follow to the point B, where they are run out on the main eastbound track.

The general freight, after its reception in the receiving yard, is classified and distributed over the several tracks of the yard for north, south and eastbound general freight, which has a capacity of 1,334 cars, and is thence pulled out over its eastern ladder track to the point B, where it reaches the main eastbound line.

Engines for eastbound general freight can reach the ladder track of the yard from the engine storage tracks at either end. For tidewater coal the engine runs out on track (6) to B and then backs up over track (5), skirting the general eastbound classification yard to D, when it crosses into the ladder track of the coal and coke yard, and thence out as already stated. In both cases, for general freight and for coal, the caboose is picked up at the extreme eastern end of the yard, which is not shown in the engraving. The classification of the general freight is accomplished by means of a hump located at the point marked "summit." The cars are pushed out upon track (7) and thence over the hump from which they drop down into the classification yard by gravity. The eastbound traffic is thus cared for without crossing or in any way conflicting with any engine or train movement in the opposite direction.

The westbound general freight traffic, which is here a light movement, is cared for by a combination of receiving and classification yard having a capacity of 1,107 cars. The trains leave the main line at the entrance to the yard and, moving over the ladder track to one of the 16 tracks forming the yard, are left to be sorted, while the engine is sent out on to the ladder at the west end. The caboose in the meantime has been dropped at the east entrance to the yard and is picked up by the outgoing eastbound train. The engine then passes out over the engine running tracks (8) on the north side of the roundhouse to the west of the standing tracks and roundhouse; backing into the same.

When a westbound train has been made up in the classification yard, the engine takes it and, hauling it to the running track (8), crosses directly to the westbound track at E, or it may continue along the running track (8) between the roundhouse and the westbound track to F, just beyond which point the caboose is coupled on.

In the case of the westbound empties, they drop the caboose as before and then follow the main track beyond the westbound general yard and the roundhouse to the point G, where they turn in and cross the running track to the ladder of the yard for westbound coal and coke empties, which has a capacity of 403 cars. The engine then runs out on the west end ladder and backs over running track (9) to the storage tracks and roundhouse.

From the receiving yard the empties are pushed over a hump located at H and dropped down into the classification yard for empties that has a capacity of 1,155 cars. The engine for westbound empties leaves the roundhouse by running track (6), which it follows to its junction with track (3); thence by way of track (9) it crosses to the westbound running track (8), which it follows along the north side of the yard to the ladder track at I. Backing in on this track it couples to its train and hauls it out over the running tracks (8) to F, where it reaches the main line and takes its caboose at the same point as the general merchandise trains.

The yard is entirely free and independent from that devoted to passenger service as well as that of the shops, and it is made of such size that it will be capable of handling, not only the present traffic but some future increase. In it the east and westbound movements are kept entirely apart. There is no crossing of the traffic, either in the yard or on the main line, and there can be absolutely no interference with the passenger trains. In these particulars this, as well as the yards at Williamson and Bluefield, is deserving of most careful study.

EAST PORTSMOUTH YARD.

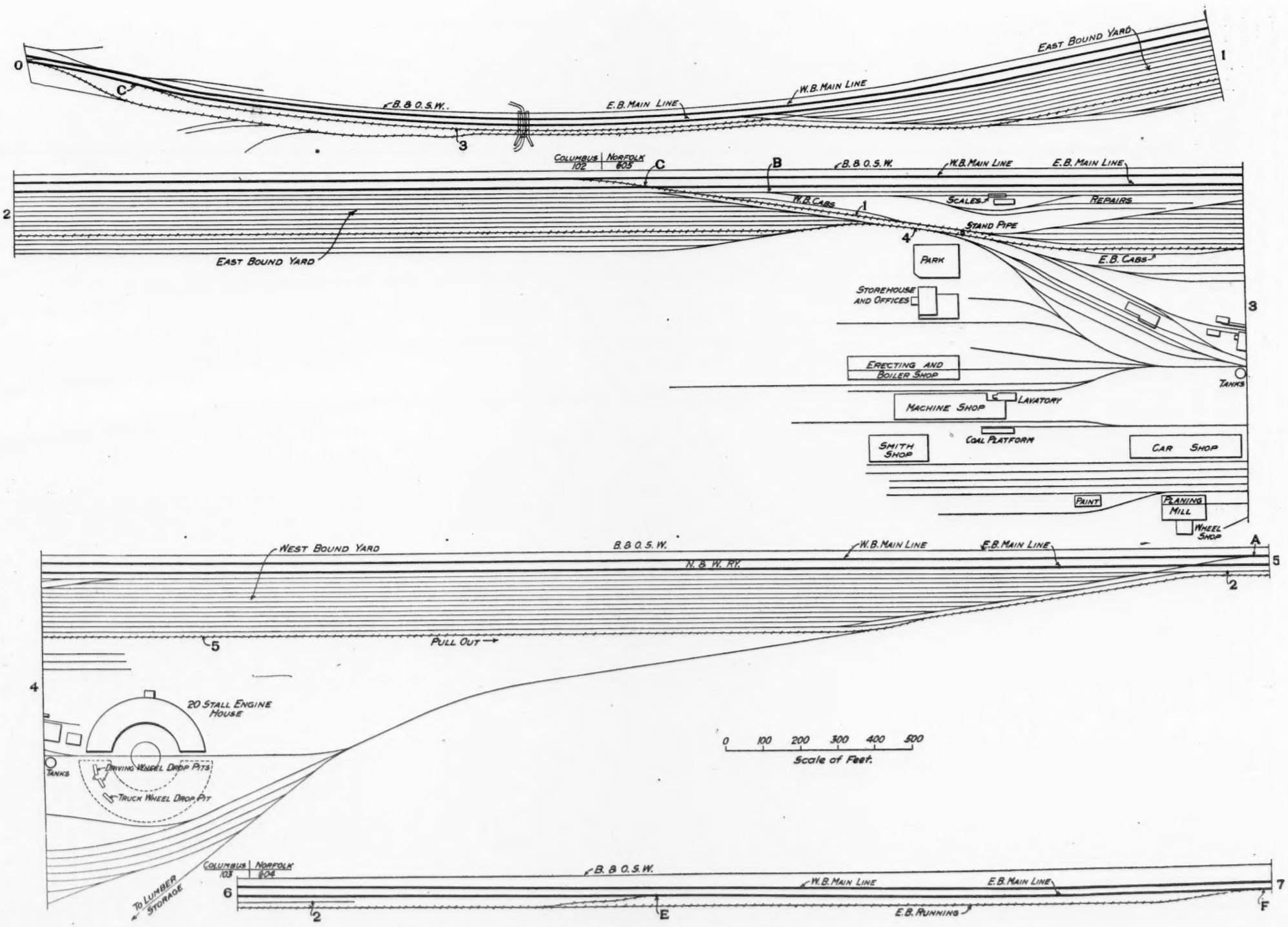
The yard at East Portsmouth, Ohio, on the Ohio river, 138 miles west of Williamson, serves as a receiving and distributing yard at the junction of the three main lines running to Columbus, Cincinnati and Norfolk. At this point the bulk of the loaded traffic is westbound and there is comparatively little that originates between that point and Naugatuck, where the Big Sandy line leaves the original line. Owing to the peculiarities of location it was impossible to place this yard between the main lines. These here run parallel to that of the Baltimore & Ohio Southwestern, and the yard is limited in length by the location of Portsmouth.

The yard is not yet entirely completed, but when it is it will have a length of about 13,000 ft. Although the ground is level near the river considerable filling has been required which amounts to about 500,000 cu. yds., and has cost about $407,000.

As the work to be done at this point is far less involved than at either of the other three, that have thus far been considered, the arrangement of the yard is correspondingly simplified. As in the case of the westbound general freight yard at Roanoke, one yard is made to serve the double purpose of receiving and classification for each direction of movement. On approaching the yard from the east, the trains hold to the main westbound track until reaching the head of the westbound yard at A, where, by means of a crossover they turn directly into the ladder track, crossing the eastbound main line in doing so. The engine then leaves the train in the yard and goes to the roundhouse from the west end by way of the running track (1), while the caboose is switched down upon the cab track.

The classification is effected by pulling the train back upon the tail track (2) and kicking the cars over the ladder and in upon the assigned tracks of the yard. When a train has been made up, the engine reaches it from the roundhouse by a reverse movement and pulls out over running track (1) picking up the caboose at B and crossing the main eastbound track again at C.

The eastbound movement is effected in the same way, except that there is no crossing of the eastbound main line. The trains enter the yard at C and follow the running track (3) that has been cleared for their reception to the ladder of the eastbound yard. The engine passes on to the roundhouse from the east ladder by way of the track (4) and the caboose is brought around the yard and



Plan of East Portsmouth Yard; Norfolk & Western.

put upon the cab track ready for delivery at B. The eastbound engine reaches its trains by a reverse movement and pulls out over the running track (5), picking up the caboose as it passes its siding. It then continues on along the south side of the yard and reaches the main line at E or F, both of which points are beyond the extreme limits of the sorting and poling tracks of the westbound traffic. Provision is made for weighing cars between the two yards, so that they may be run out over the scales and poled back as required. With this arrangement there is no interference between the east and westbound movements as far as the freight work is concerned. The only interference being in the hauling of the westbound freight trains across the eastbound main tracks as they enter and leave the yard, a matter that, owing to the light character of the passenger traffic at this place is of no importance, especially as this crossing is done between the points where the eastbound freight enter and leave the yard.

SOUTH NORFOLK YARD.

The new yard at South Norfolk is intended for the sole purpose of a receiving yard for eastbound traffic in order to relieve a possible congestion at Lambert's Point and the city yards. It is at Lambert's Point that the road has its tidewater terminal from which the coal is delivered to vessels. This terminal was fully described in the *Railroad Gazette* of July 24, 1903. In loading or waiting for vessels it frequently occurs that there will be an accumulation which if run into the terminal would so congest it as to hinder the work. For that reason this yard has been built on the outskirts of Norfolk and the borders of the Dismal Swamp. As already stated, it is intended for eastbound traffic only and has no provision for doing any westbound work. It has a length of about 12,800 ft., and, when completed, will be provided with a hump between the receiving and classification yards.

It is built upon low but firm ground and is raised above the natural surface. Although this natural surface is level, the extent of the yard involved a correspondingly large amount of material to be placed, amounting in all to 120,000 cu. yds., and its cost up to date is $132,000, but the yard is not yet complete.

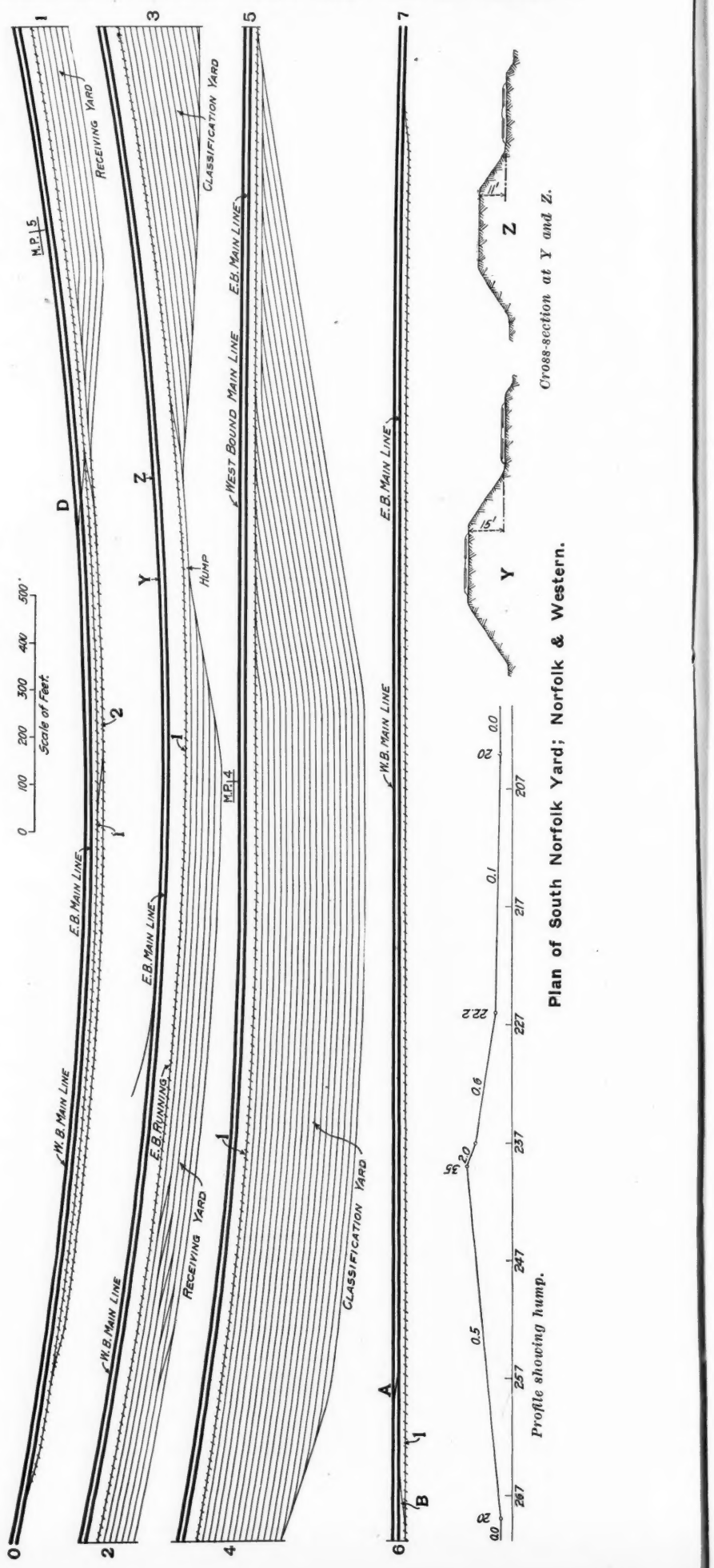
Inasmuch as the yard has to deal with traffic in one direction only, it was unnecessary to place it between the tracks of the main line in order to avoid an interference. It is, therefore, placed outside these lines and to the south of them on the side of the eastbound track which it is intended to serve. Trains approaching it from the west leave the main line at the west entrance and swing off upon running track 1. If the train is to be broken or is intended for the receiving yard it is run in on track 2, which is a westbound continuation of the ladder of the receiving yard. It can then be run direct in upon its proper track. If, however, no work is to be done upon it, it may continue along the main track to the terminal yards.

In the receiving yard there are cross-overs between adjacent tracks, so that one train can be shifted ahead of another whenever it is so desired. The work at the hump is, of course, to be conducted in the ordinary manner. It will be noticed that at the east end of the classification yard there are two ladders serving eight and 10 tracks respectively, and each delivering to running track 1. This is to enable two engines to work at that end of the yard at the same time without interfering with each other.

When a train is ready to be sent to Norfolk an engine is sent out over the westbound track and it can cross to the eastbound at A and back into its train. When pulling out, it may go directly upon the eastbound track at B or continue on down the running track 1, where it may wait for orders and go out on the main line at C. There is also a cross-over from the east to the west line near the western end of the yard at D. In these yard movements the cabooses are pulled out of the receiving yard and sent in to Norfolk over the running track 1 with the engine.

As the movement is all in one direction the detail of all of the yard work is equally simple, both that relating to the movement of the cars and the clerical work attending it as will be shown in a later article.

These yards are shown in this detail because it is the intention to set forth in a later article the methods of operation followed in them in caring for and recording the cars as they pass through and also to show the value of the principle laid down at the outset of so constructing them that there is a free movement of traffic in both directions without the interference of one with the other. Where the whole yard is between the main line tracks, as at Roanoke and Williamson, this is comparatively easy of accomplishment, though study will be required in order to pass one by the other within these limits and still leave free access to roundhouses and storage yards. There the yard must be on one side of the main line, as at Bluefield and East Portsmouth, the problem becomes more difficult, but not impossible of solution with single crossings of one main line track and none in the case of the opposing currents of the freight traffic. Studied independently each of these yards is well worthy of attention, but taken together and with their fundamental principle kept in mind they form a most interesting exemplification of what can be accomplished along lines that have been definitely fixed and still have the flexibility demanded by a widely varying topography. This varies from the flat, open, unobstructed country at Norfolk to the level bottom land that is abruptly bounded by hills at East Portsmouth, to the heavy rolling territory of Roanoke, through the hilly, rough topography of Bluefield, to the narrow, tortuous valley of the Tug river at Williamson. Variations in detail were called for at every point and so there will be needed variations in the detail of operation in order that the traffic may be forwarded without delay. It is this variation of



Plan of South Norfolk Yard; Norfolk & Western.

detail that lends interest to the whole when considered as a unit that has been adapted to the conditions that it has been called upon to meet.

(To be continued.)

Government Accident Bulletin No. 22.*

The Interstate Commerce Commission has issued Accident Bulletin No. 22, containing its report of railroad accidents in the United States during the three months ending December 31, 1906. The number of persons killed in train accidents was 474 and of injured 4,940. Accidents of other kinds bring the total number of casualties up to 20,944 (1,430 killed and 19,514 injured). These reports deal only with (*a*) passengers and (*b*) employees on duty.

TABLE No. 1.—*Casualties to Persons.*

	Passengers.		Employees		Tot'l persons reported	
	Kil'd.	Inj'd.	Kil'd.	Inj'd.	Kil'd.	Inj'd.
Collisions	119	1,630	189	1,330	308	2,960
Derailments	61	892	85	625	146	1,517
Misc. train accidents, inc. boiler explo...	..	26	20	437	20	463
Total train accidents	180	2,548	294	2,392	474	4,940
Coupling or uncoupling	..	...	84	1,083	84	1,083
While doing other work about trains...	..	...	79	4,464	79	4,464
In contact with overhead bridges, etc....	2	18	35	407	37	425
Falling from or getting on cars or engs.	34	540	229	3,280	263	3,820
Other causes	18	563	475	4,219	493	4,782
Total (other than train accidents)..	54	1,121	902	13,453	956	14,574
Total all classes	234	3,669	1,196	15,845	1,430	19,514

The totals of collisions and derailments and of deaths and injuries caused by them continue very large. The general cause of the increase over former periods, so far as it is possible to speak definitely on the subject, has been repeatedly stated in these bulletins, and need not be given here. The specific causes of the more prominent accidents are given in connection with Table 2*a* as usual. The number of passengers killed in train accidents in this quarter, 180, is the largest on record except that for the quarter ending September 30, 1904 (Bulletin No. 13), when it was 228. Bulletin No. 10 contained the next highest record. The totals under this head, in this and the 12 bulletins last preceding, are as follows:

Passengers Killed in Train Accidents.

Bulletin No.	Quarter ending	Killed.	Bulletin No.	Quarter ending	Killed.
22.	December, 1906..	180	14.	December, 1904..	53
21.	September, 1906.	52	13.	September, 1904.	228
20.	June, 1906.	27	12.	June, 1904.	23
19.	March, 1906	62	11.	March, 1904	40
18.	December, 1905..	50	10.	December, 1903..	*a*147
17.	September, 1905.	43			
16.	June, 1905	41			
15.	March, 1905. ...	28			

a Three times the average of the nine preceding quarters.

The five principal accidents in Bulletin No. 13, with the number of persons killed in each, were: A bridge disaster in Colorado, 88; a butting collision in Tennessee, 63; a derailment at a misplaced switch in Illinois, 24; a collision in Illinois, 18, and a collision in New Jersey, 16.

Bulletin No. 10 includes a derailment in Pennsylvania, due to an accidental obstruction, 65 killed; a collision in Louisiana, 32; a collision in Michigan, 18, and one in Indiana, 16. Besides these disasters to passenger trains, there were in that quarter two collisions of work trains, killing 17 and 16 employees, respectively.

The other principal items in the present bulletin, compared with the last preceding quarter and with the quarter one year ago, appear as follows:

	Bulletins		
	No. 22.	No. 21.	No. 18.
1. Passengers killed in train accidents	180	52	50
2. Passengers killed, all causes	234	110	101
3. Employees killed in train accidents	294	215	320
4. Employees killed in coupling	84	81	85
5. Total passengers and employees killed, all causes	1,430	1,182	1,109

Of the 180 fatalities in this quarter, as shown above, 143 are attributable to three accidents—collisions No. 23 and No. 28 (Table 2*a* following) and derailment No. 10.

TABLE No. 2.—*Collisions and Derailments.*

	No.	Loss.	Persons Killed.	Persons Injured.
Collisions, rear	588	$627,125	113	907
" butting.	297	500,011	128	1,089
" trains separating	174	50,210	4	85
" miscellaneous.	1,167	539,533	63	879
Total collisions	2,226	$1,716,879	308	2,960
Derailments due to:				
Defects of roadway, etc	341	$250,231	8	648
Defects of equipment	771	569,550	20	167
Negligence of trainmen, signalmen, etc.	147	119,809	69	192
Unforeseen obstruction of track, etc...	68	72,626	13	66
Malicious obstruction of track, etc....	14	17,113	1	32
Miscellaneous causes	398	353,020	35	412
Total derailments	1,739	$1,382,349	146	1,517
Total collisions and derailments....	3,965	$3,099,228	454	4,477

*Six of the accidents in Table 2-A may be identified by reference to the *Railroad Gazette* accident reports for the months named:

Collision No. 22, December, Enderlin, N. D.
" " 23, December, Terra Cotta, D. C.
" " 25, October, Lansingburg, N. Y.
" " 28, November, Woodville, Ind.
" " 30, November, Lawyer, Va.
Derailment No. 10, October, Atlantic City, N. J.

Following is the usual list of Class A train accidents—all in which the damage is reported at $10,000 or over; notable cases in which passengers are killed, and those doing damage less than $10,000 and down to $2,000, wherever the circumstances or the cause may be of particular interest:

TABLE 2*a*.—*Causes of Forty Prominent Train Accidents (Class A).*

[NOTE.—R., stands for rear collision; B., butting collision; M., miscellaneous collisions; D., derailment; P., passenger train; F., freight and miscellaneous trains.]

No.	Class.	Kind of train.	Killed.	Injured.	Damage to engines, cars & roadway.	Reference to record.	Cause.
					Collisions.		
1	R.	P. & F.	1	10	$2,300	55	Freight train, stopped by automatic block signal, run into at rear by passenger train, which had overrun automatic disk block signal, the face of which was partly covered by snow. Engineman appears to have taken chances.
2	B.	F. & F.	1	5	2,560	85	Operator wrote "95" for "75" in telegraphic order.
3	R.	F. & F.	0	0	3,000	87	Block signalman B. authorized A to clear signal when block was occupied; engineman approached station in fog with speed not under proper control.
4	B.	F. & F.	0	0	3,192	10	Signalman gave false clear block signal to westbound train; operator failed to deliver order to eastbound train; one of these men in service 18 days, the other 8 months.
5	B.	F. & P.	1	11	4,000	45	Two empty engines, coupled together, encroached on time of regular passenger train; second engineman depended on the first; the first misread time by watch.
6	R.	F. & P.	2	26	4,475	79	Freight train approached station in fog with speed not under proper control.
7	B.	P. & F.	2	33	6,900	9	Operator omitted word "second" from order; operator in service 6 weeks.
8	R.	P. & F.	0	3	7,000	6	Signalman (1 a.m.) gave false clear block signal; flagman failed to go back, though instructed by locomotive whistle signal to do so. Signalman, 34 years of age, in service 8 days.
9	B.	F. & F.	5	1	7,600	19	Men in charge of eastbound train overlooked meeting point.
10	B.	P. & F.	3	24	8,500	13	Freight approached meeting place with speed not under proper control; conductor and engineman appear to have passed a switch without knowing it.
11	M.	P. & F.	2	24	9,056	82	Switch wrong; believed to have been maliciously misplaced.
12	B.	F. & F.	1	1	9,400	56	Operator omitted "2d No. 155" from order, though he repeated it to despatcher correctly; operator in service 39 days.
13	M.	F. & F.	0	0	10,300	72	Freight train without engine left standing on grade with no hand-brakes set; ran back down grade.
14	B.	F. & F.	4	3	10,998	16	Operator failed to deliver meeting order; operator decamped.
15	B.	P. & F.	3	7	12,330	14	Eastbound freight encroached on time of westbound passenger; engineman killed; conductor evidently reckless.
16	B.	P. & P.	1	49	12,500	1	Engineman's watch wrong; see note in text below.
17	R.	F. & F.	0	2	12,553	48	Failure to flag, and excessive speed.
18	B.	F. & F.	0	3	13,000	80	Operator fell asleep and failed to deliver meeting order; on duty 24 hours; his superior ignorant of this.
19	B.	F. & F.	4	3	13,200	76	Conductor and engineman of extra train made mistake of 1 hour in reading timetable. Engineman, 18 months in service, was killed; conductor 6 months in service.
20	B.	P. & F.	1	13	14,000	91	Despatcher sent order reading "No. 50." Order delivered read "No. 52." Impossible to decide whether error is chargeable to despatcher or to the receiving operator.
21	B.	F. & F.	3	3	14,543	17	Operator, holding three orders for train, delivered only two.
22	B.	P. & F.	9	66	15,000	74	Passenger train (1 a.m.) collided with switching freight train at entrance of yard. See note in text below.
23	R.	P. & F.	43	63	16,000	83	See note in text below.
24	B.	F. & F.	2	5	16,763	57	Northbound extra train overlooked order to clear track for southbound extra train; no explanation of forgetfulness.
25	R.	P. & P.	5	20	20,400	2	Extra passenger train ran into regular passenger train standing at station. See note in text below.
26	R.	P. & F.	1	9	21,900	73	Passenger train ran past automatic block signal and flagman; engineman killed. He made no effort to stop, and it is believed he had in some way been incapacitated before the collision.
27	B.	P. & F.	0	6	25,520	89	Misplaced switch at entrance of passing track. Wreck destroyed by fire, which appears to have started in a car of oil.
28	B.	P. & F.	43	155	37,000	40	See note in text below.
29	R.	F. & F.	0	11	38,000	114*a*	Rear collision of freights due to false clear block signal and nonobservance of yard speed limit. Passenger train on adjacent main track wrecked because not time to warn it. Wreck burned by fire from caboose stove.
30	B.	P. & F.	7	8	55,615	58	False clear block signal. See note in text below.
Total			144	564	$427,605		
					Derailments.		
1	D.	F.	0	0	$4,994	28	Careless running on descending grade: conductor and engineman on duty 23 hours.
2	D	P.	2	14	5,700	64	Angle-bar broken by shortening of rails

No.	Class.	Kind of train.	Killed.	Injured.	Damage to engines, cars & roadway.	Reference to record.	Cause.
							due to cold weather; speed 55 miles an hour.
3	D.	P.	0	22	7,500	66	Unexplained; speed 55 miles an hour.
4	D.	P.	0	49	7,700	35	Broken rail; speed 60 miles an hour. Rail had excess of phosphorus and manganese.
5	D.	P.	0	45	9,148	34	Unexplained; speed 60 miles an hour.
6	D.	F.	0	0	10,000	29	Drawbar pulled out.
7	D.	F.	0	0	10,200	109	Unexplained; 14 cars fell through trestle; wreck took fire, probably from heated journal.
8	D.	P.	0	10	15,726	32	Low joint; sudden application of brakes; speed 25 miles an hour. Section foreman dismissed.
9	D.	F.	1	6	16,000	71	Runaway on steep grade; mismanagement of air brakes.
10	D.	P.	57	36	20,000	36	Rail out of place at entrance of drawbridge. See note in text below.
Total.....			60	182	$106,968		
Grand total.			204	746	$534,573		

Collision No. 23, causing the death of 43 passengers and the injury of 63, occurred at Terra Cotta, D. C., on the Baltimore & Ohio Railroad, on the night of December 30, 1906, between 6.30 and 7 o'clock. The night was dark and a dense fog prevailed. The leading train, No. 66, had just stopped at the station when it was run into at the rear by a following extra train, consisting of an engine and eight empty passenger cars, and its rear car was completely wrecked. The circumstances of this collision are under investigation, and the Commission intends to issue a special bulletin containing a summary of the facts and its conclusions therefrom.

Collision No. 28, resulting in the death of 42 passengers and one trainman, and the injury of 150 passengers and five trainmen, was between a westbound passenger train and an eastbound freight. It occurred about 3 o'clock in the morning during a blinding snowstorm. The engines were wrecked and took fire, and five passenger cars, one baggage car and three freight cars were burned up. The bodies of the passengers who were killed, except two, were consumed in the fire. The passenger train was No. 47, second section. The first section of the passenger train carried green flags to indicate to freight trains running in the opposite direction that they must keep out of the way of the second section, but the freight in this case did not get, or did not heed, the signals, and started out from a side track, where it had been waiting, immediately after the passage of the first section. The signal lights fixed on the passenger engine close to the signal flags were not burning, and therefore the men in charge of the freight had no visual notice that there would be a second section of the passenger train.

To provide against the failure of lights in such cases the engineman of the passenger train is required to sound a whistle signal at the point where he meets a freight train. In this case the engineman says that he sounded the whistle, indicating that he was carrying green signals, and the men in charge of the freight admit that they heard a whistle signal, but thought it sounded like a crossing signal. The signal which should have been given consists of one long blast and two short blasts, while that for a highway crossing consists of two long and two short blasts. Whatever may have been the character of this signal, the engineman of the freight, if he understood it to be a notice of a second section, should have acknowledged it by sounding the whistle of his engine. He did not sound this signal. This being so, it was the duty of the engineman of the passenger train, under the rule, to stop and give the proper notice to the freight train by word of mouth. This was not done, and the passenger engineman can give no excuse for his failure to do so. This engineman is reported as having a clear record for the five years preceding the accident. As to the extinguishment of his signal lights, he says that they were burning when he left a station about 30 miles east of the point of collision. The snow was falling rapidly at the time and the wind was blowing a gale, and he appears to have allowed the lamps to go out without paying attention to the fact. This engineman had been in the service of the road 16 years, and had been on duty two hours and 30 minutes, after a sufficient time for rest.

Derailment No. 10 was due to an unexplained fault in a drawbridge. The train, southbound, was made up of three cars, propelled by electricity, the leading car being the motor car. It was running at ordinary speed, probably 30 to 40 miles an hour. At the entrance of the drawbridge the leading car jumped the track and, after running a short distance on the ties, the leading truck of the car rode over the guard timber at the outer edge of the bridge floor, and the car, with the two following it, fell into the stream below. Of the passengers in the cars 56, with the motorman—57 persons in all—were drowned, and 36 passengers were injured. The drawbridge is of the "turntable" style, turning on a vertical axis. It had been opened for the passage of a vessel a short time before. Preparatory to opening, the rails of the track at the end of the draw, which extend over a few inches onto the fixed span adjoining, had been lifted so as to clear the fixed rails during the movement of the bridge. When the bridge was returned to its normal position for the movement of trains the supports under these lifted rails were withdrawn, and the rails should have dropped into place by gravity. For some reason, not explained, one or both of the rails of the southbound track did not thus drop, though the bridge itself was locked in position; and this caused the derailment. The attendant in charge had failed to notice the fault, although he stepped to a point within a few feet of the end of the draw to take up a red flag which, according to the regulations, he had displayed on the fixed span as an auxiliary stop signal while the draw was open. Not seeing the misplaced rail, he took up the flag and notified the signalman in the cabin south of the draw that the fixed semaphore signals might be cleared for trains. These fixed signals were interlocked with the bridge, but not with the track rails, and therefore there was nothing to prevent the giving of the clear signal to this train, notwithstanding the imperfection in the track.

The attendant at the bridge who thus wrongfully authorized a clear signal was 65 years old, a man of experience in positions of this kind, and with a good previous record.

Collision No. 16 was between passenger train No. 601, westbound, and passenger train No. 10, eastbound, between the switches at the station where they were ordered to meet. The eastbound train had the right to the track and the westbound encroached on its time in consequence of the engineman's watch being slow. It is the conclusion of the superintendent that the engineman had allowed his watch to run down. The westbound train should have entered the side track east of the point of collision, and for this the conductor, as well as the engineman, is held responsible.

Collision No. 22 occurred in the middle of the night and was due to the neglect of a flagman to give a warning signal a sufficient distance from his train. The passenger train was approaching a station at full speed and ran into a freight train switching on the main track. The flagman of the freight had been instructed to go out two miles, but he only went about 1,500 ft., and then stopped on a curve where the engineman of the approaching passenger train could see him for only a very short distance before reaching him.

Collision No. 25 was due to a combination of high speed and an insufficient time interval between trains carrying passengers. A regular westbound passenger train standing at a station was run into by a following extra passenger train carrying troops and horses, and consisting of 18 live-stock cars, nine sleeping cars and a caboose. This train had left the last preceding station about four minutes behind the regular train, and was run at high speed (about 60 miles an hour or faster over a line where the grade was descending at 40 ft. per mile)—so high that on approaching the station the engineman was unable to obey the stop signal given by the flagman of the train standing at the station, who had gone back about 1,400 ft. and who was in a position where the engineman of the troop train could see the flag in time to have a space of about 2,000 ft. in which to stop. He was unable to do this, and his engine struck the standing train while running at about 20 miles an hour. This engineman was held responsible for the collision, and the conductor of the train also for permitting the excessive speed. Both of these men, as well as those in charge of the regular train, were also held blameworthy for not complying with the rules regarding despatcher's orders, the regular train having passed the extra train without authority when the men of both trains held orders under which the extra train should have kept ahead. Of the 28 cars in the extra train 24 were air-braked.

Collision No. 30 occurred about 6.15 a.m. on a line worked by the telegraph block system. Southbound passenger train No. 33 of the Southern Railway left Rangoon, Va., at 6.06 a.m., and after running about 1½ miles was stopped by the automatic application of the air-brakes, caused by the parting of the train, the parting being due to the failure of the drawbar of an express car in which the coupler was defective. About three or four minutes after the train had come to a stop it was run into at the rear by a following passenger train, No. 37, and the rear car of the standing train was crushed, seven persons in it being killed. Eight persons on the train were injured. Train No. 37 had passed Rangoon at 6.14 a.m., the signalman at that point giving it a clear block signal. This signalman, 22 years of age, and in the service of the company two and one-half years, asserts that the signalman at Lawyers, the south end of the block section, had reported the passage of No. 33. The signalman at Lawyers denies this, and his records, on which no entry was made for No. 33, bear out his statement. The flagman of train No. 33 had gone back between 300 and 400 yards to warn the following train, but the line of the road at this point is descending about 60 ft. to the mile, the train was running at high speed, and the flag signal was unavailing. This collision, like No. 23, may be made the subject of a special report.

Representatives of the business and manufactures of Moscow cry aloud to the authorities for improvements in transportation which will secure the supply of fuel, lack of which threatens to cripple this the greatest manufacturing city of Russia. They say the average consumption of the city per year for five years has been, all in tons: Wood, 3,816,800; coal, 1,261,800; petroleum, 3,978,-

000. The cost of coal is about $6.30 per ton. An equivalent quantity of petroleum costs 9 per cent. more, and of wood 14 per cent. more. But the wood is giving out and is especially of minor importance in manufactures. Petroleum is subject to great fluctuations in prices and now costs more than twice as much as a few years ago; and the only permanent dependence must be on coal from the Donez mines, which are about 570 miles distant by the present rail route. New lines, double tracks, and big American cars are called for.

Prussian State Railway Signals.

BY W. H. POCKELS.

On the Prussian State Railways, for the control of the traffic, signals can be divided into six parts:

1. Disc-signals.
2. Signals on signal posts.
3. Vorsignale.*
4. Signals on water towers.
5. Point signals.

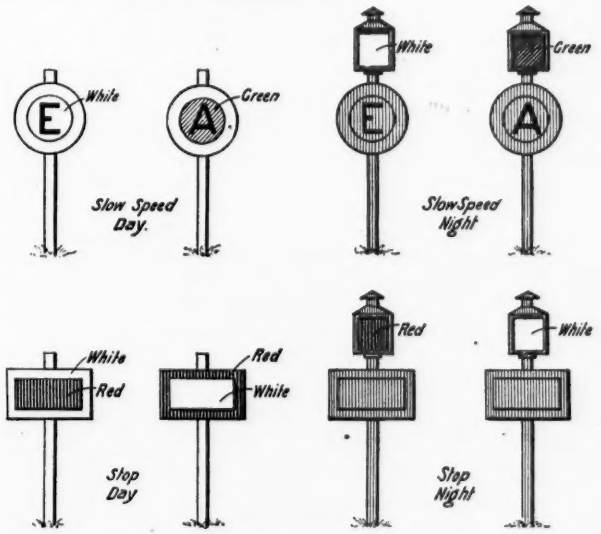


Fig. 1—Disc Signals.

Slow Speed.

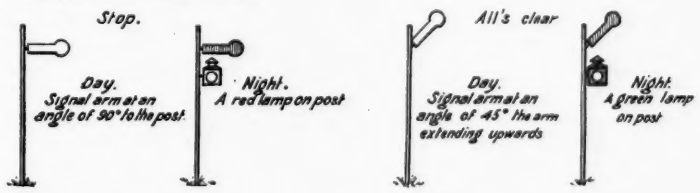
Day.—At the beginning and end of a stretch of rail where the train must travel at slow speed, two discs are placed. The advancing train perceives a round disc colored green with a white edge and the letter A (Anfang = beginning); at the other end a white disc with the letter E (Ende = end).

Night.—On the discs are placed lamps—A green and E white.

Stop such as by a repaired line or dangerous spot.

Day.—A rectangular disc is placed painted red having a white border.

Night.—A red lamp.


Stop.
Day. Signal arm at an angle of 90° to the post
Night. A red lamp on post
All's clear
Day. Signal arm at an angle of 45° the arm extending upwards
Night. A green lamp on post

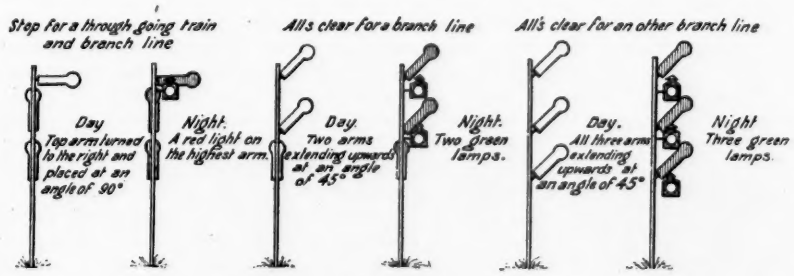

Stop for a through going train and branch line
Day Top arm turned to the right and placed at an angle of 90°
Night. A red light on the highest arm.
All's clear for a branch line
Day. Two arms extending upwards at an angle of 45°
Night. Two green lamps.
All's clear for an other branch line
Day. All three arms extending upwards at an angle of 45°
Night Three green lamps.

Fig. 2—Semaphore Signals.

Stop.

All's clear.

Stop for a through-going train and branch line.

All's clear for a branch line.

All's clear for another branch line.

Bracket signals are used at junctions, the left-hand signal used for the line on the left extending upwards to perhaps 10 or more arms.

*Warning signals in advance of the main signal.

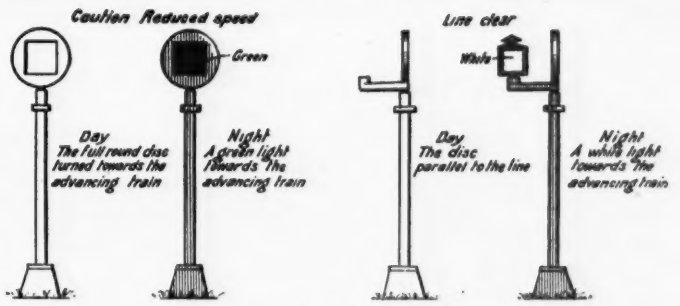

Caution Reduced speed
Green
Day The full round disc turned towards the advancing train
Night A green light towards the advancing train
Line clear
White
Day The disc parallel to the line
Night A white light towards the advancing train

Fig. 3—Distant Signals.

Where the signal post is hidden from the sight of the driver by means of a curve in a cutting, or by a tunnel or bridge, vorsignale (warning signals) are used, consisting of a movable disc, to which is applied a lantern for night purposes.

4. WATER TOWERS.

1. The discharge pipes of the crane, like the ordinary English ones, move on a pivot. When in use they turn till at right angles to the line, when not in use they are turned parallel to the line.

2. At night they are registered when parallel to the line by a white light.

3. When at right angles to the line a red light is shown to the advancing object.

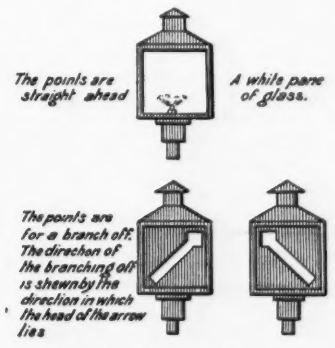

The points are straight ahead
A white pane of glass.
The points are for a branch off. The direction of the branching off is shewn by the direction in which the head of the arrow lies

Fig. 4—Point Signals.

The use of the point signals is to show from a distance the curves of the railroad to the driver.

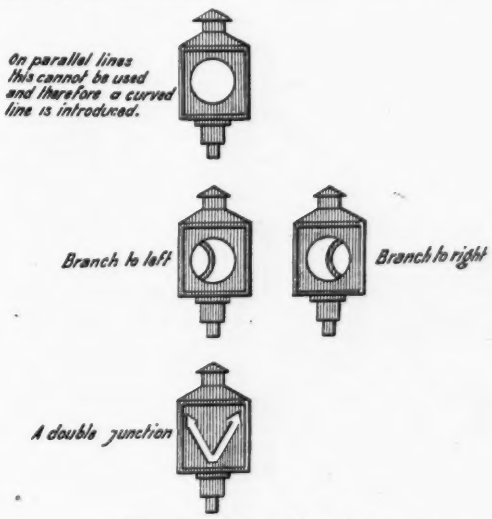

On parallel lines this cannot be used and therefore a curved line is introduced.
Branch to left
Branch to right
A double junction

Fig. 5—Point Signals.

In addition to these signals, I also include a brief description of:

1. Signals with electric bells and horns.
2. Hand-signals by the officials.
3. Head and tail lights.
4. Signals of the train staff.
5. Shunting signals.

I have extracted a few of the rules for the instruction of the railroad employees:

1. The electric bells are rung in groups of five seconds between each.

2. Signals 1 and 2 are the means of warning the railroad servants of the start of a train from one station to another.

3. If a locomotive has not reached the electric bell after it has been sounded 15 minutes, the start signal must be sounded again.

4. The danger signal serves to warn the neighboring station or bahnwärter of an important obstruction on the line, such as, line not clear, accident, etc.

5. The horn-signals I. and III. serve as a warning signal on

branch lines where the traffic is not so important, and also for the gangers working on the line.

6. The signal IV. is given by the bahnwärter:

(1) When he hears his neighbor give it.

(2) When he notices a train movement of which no previous notice has been given, such as special light engine.

(3) When he notices anything out of the ordinary on a passing train which might cause disaster.

1. SIGNALS WITH ELECTRIC BELLS AND HORNS.

Audible Signals.

1. The train goes in the direction from A— B (starting signal)	One special ring of the bells.
2. The train goes in the direction from B— A (starting signal)	Two special rings of the bells.
3. The train is not to proceed (stop signal)	Three special rings of the bells.
4. Something special on the line (danger signal)	Six special rings of the bells.

Horn Signals..

I.	Signal — ◡ ◡ —	once.
II.	" — ◡ ◡ —	twice.
III.	" — — — —	four times.
IV.	" ◡ ◡ ◡ ◡	twice.

2. HAND SIGNALS.

The hand-signals of the bahnwärter are as follows:

Slow Speed.

Day.—Any article held at arm's length at right angles to the line (usually the flags in their case).

Night.—A lamp held at arm's length with a green light.

Stop.

Day.—Any article held at arm's length and swung round so as to describe a circle (a red flag is generally used).

Night.—A lamp held at arm's length and swung round so as to describe a circle, the lamp showing a red light.

3. HEAD AND TAIL LIGHTS.

(*a*) When a train travels over a single line, or on the line especially set apart for the train.

(1) In daytime.—No special signal.

(2) At night.—Two white lamps in front on the frames.

(*b*) When the train travels exceptionally, not on the line set apart for the purpose, or in the case of a non-scheduled train on a branch line.

(1) In daytime.—The locomotive carries before the funnel a red circular disc with a white border.

(2) At night.—Two red lamps in front on the frames.

If the locomotive is not attached to the front of the train, or travels tender forwards, the lamps must be placed in the very front of the train.

(*a*) On the last vehicle of the train:

(1) By day—A red and white circular disc is placed on the left buffer, and two quadrilateral discs, of red and white color, the diagonals, alternately colored red and white, are placed at the top of the wagon or carriage.

(2) At night.—Lamps take the place of discs.

A special train is recognized:

On the last vehicle of the train, by day, a red and white circular disc is placed on the left buffer, and a green circular disc is placed on the back in the topmost corner, the other corner being occupied by a red and white quadrilateral disc.

At night the discs are replaced by lamps.

(*b*) A train coming in the opposite direction carries at the stack by day a green circular disc, by night a green lamp.

4. SIGNALS OF THE TRAIN STAFF.

(*a*) With the steam whistle:

(1) Warning—a long tone ——.

(2) Put on the brake—(*a*) A little—A short tone ◡.
(*b*) Hard—Three short tones ◡ ◡ ◡.

(3) Take the brake off—Two long tones —— ——.

(*b*) With the mouth-whistle:

(1) Take your seats, please—a long tone ————.

(2) Start—Two long tones —— ——.

5. SHUNTING.

With the mouth-whistle or horn:

(1) Proceed—A long tone ——.

(2) Reverse gear—Two long tones —— ——.

(3) Stop—Three short tones ◡ ◡ ◡.

Shunting by hand signals:

(1) Proceed.—Moving the arm from a horizontal position upwards, then downwards. At night the same process, but holding a lamp.

(2) Reverse gear.—Horizontally moving the arm from right to left. At night the same process, but with a lamp.

(3) Stop—Moving the arm in a circular direction, keeping it perfectly stiff. At night the same process, but holding a lamp.

Standard Locomotives of the Midland Railway.

The accompanying engravings illustrate four of the standard freight and passenger locomotives that are in use upon the Midland Railway of England. These engines may be taken as representative of the characteristics of English design in that they are marked by extreme simplicity in all their lines and are equally divided between inside and outside cylinders, though in the case of the four-coupled compound express passenger locomotive the outside cylinders are the low-pressure ones of a three-cylinder type. In this engine, shown in the reproduction of the photograph of No. 2,632, there is but one high-pressure cylinder, and that is between the frames, thus reversing the arrangement of the well-known Webb compound in which there were two high and one low-pressure cylinder, the latter being between the frames; and following the arrangement that was used in France in the eighties, but which has since been discarded for the four-cylinder machine. These machines have cylinders of 19 in. and 21 in. diameter, so that the ratios of volume between the two sets is as 1 to 2.44, showing the tendency of modern practice to put this ratio higher than it was a few years ago. The cylinders have an inclination to the rear, in order that they may be raised to clear the truck wheels. As for weights, this engine is crowding pretty close up to what we are pleased to consider American standards. A weight of 43,380 lbs. on the front pair of driving wheels puts a load on each wheel that is well up in the scale.

The inside-connected express passenger locomotive, of which a photograph of No. 845 is reproduced, is of a somewhat lower capacity than the three-cylinder compound, but is also used in high-speed service. In neither of these engines is there any equalization of the weight between the two pairs of drivers, a condition that is considered so absolutely essential on engines in the United States. It also appears, too, from tables that are issued that the ratio of adhesion to weight on drivers is put somewhat lower on the Midland than is usually considered in calculations in the United States, though it is about the same as that actually allowed for working conditions. A difference is also made in the matter of adhesion as to whether sand is used upon the rail or not. Without sand the adhesion is calculated on the basis of 450 lbs. resistance per ton of weight, or about 20 per cent., and with sand it is placed at 607 lbs., or about 27 per cent. When sand is used it is blown on the rail by a steam jet.

The determination of the tractive power of these locomotives is done by means of the indicator, but the work is also calculated by the formula:

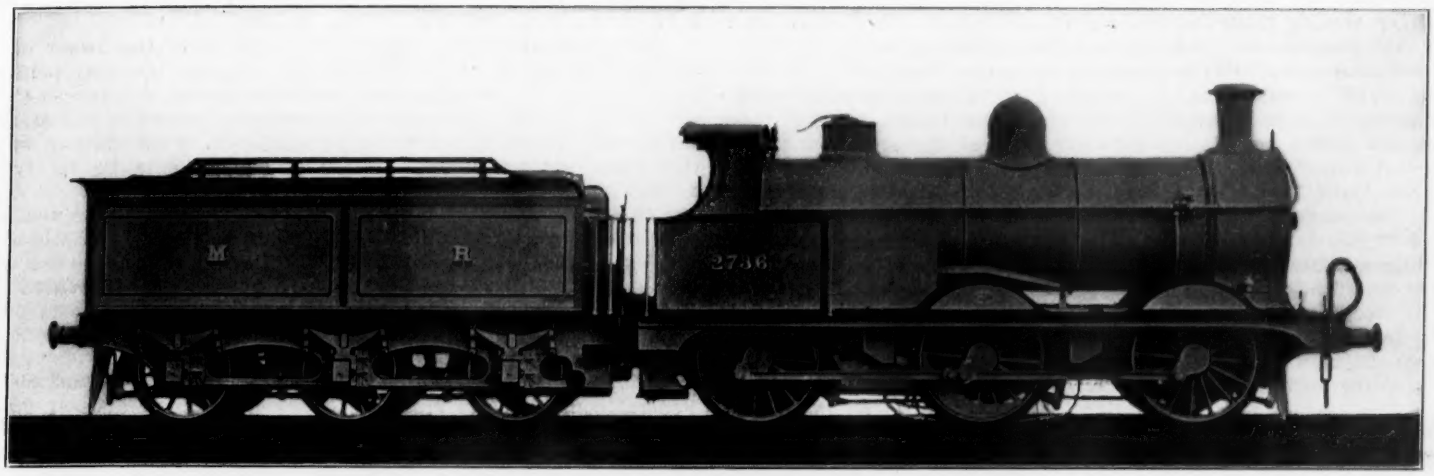
$$T = \frac{p\ d^2\ L}{2240\ D},$$

in which, T = tractive power in tons,
d = diameter of cylinders in inches,
L = length of stroke in inches,
p = maximum boiler pressure minus 40 lbs.

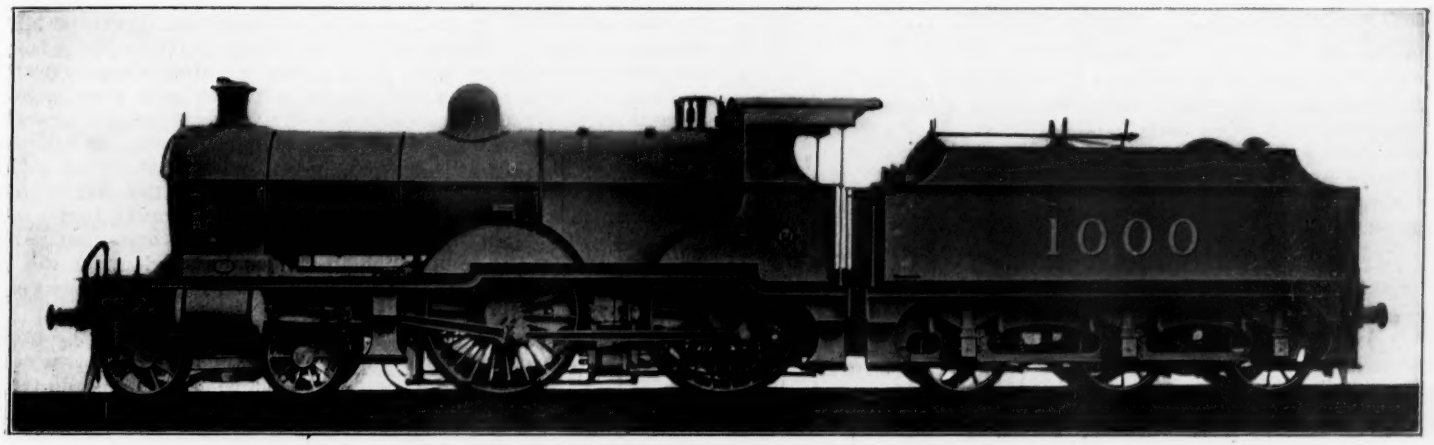
It will be seen that though this formula is identical in form with that used in this country it differs materially from it in expression and in assumed constants. The expression differs in giving the result in tons instead of pounds, which is immaterial, but in the assumed pressure there is some difference as well. The general practice in the United States is to assume the maximum mean effective pressure to be 85 per cent. of the boiler pressure, no matter what this may be. The Midland formula, on the other hand, makes a specific reduction of pressure from that of the boiler, so that the assumed mean effective pressure advances more rapidly, in proportion, than that of the boiler, becoming 80 per cent. of the same at 200 lbs. and dropping to 73⅓ per cent. at 150 lbs.

All the compounds on the Midland are of the three-cylinder type, and one that is somewhat heavier though possessed of the same general characteristics as No. 2,632 is shown in the reproduction of the photograph of No. 1,000. This engine weighs 3,024 lbs. more than the other, of which 2,128 lbs. are upon the driving wheels. This increase of adhesion, brought about by the increase of weight, is met by a raising of the steam pressure from 195 lbs. to 220 lbs. The tanks are of the same capacity, though that used on No. 1,000 is the heavier of the two. In the tractive power calculated for these two engines the effect of the fixed reduction for the mean effective pressure becomes apparent, for though the cylinders remain the same the difference in the steam pressure causes a rise of 26 per cent. in the tabulated tractive power, although the actual increase of boiler pressure is less than 13 per cent. This tractive power, it will be remembered, is deduced from indicator cards. In general appearance there is but little difference between the two engines, though there is in the arrangement of the details, as will be seen by a comparison of the engravings.

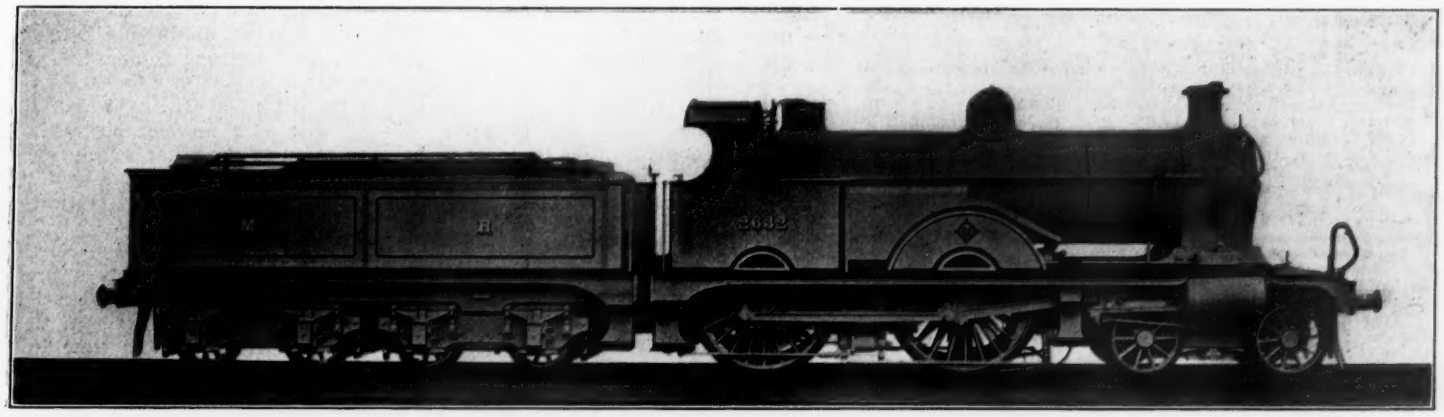
The fourth engine shown (No. 2,736) is a six-coupled goods engine, and, in one way serves as an example of the persistence of a type. In the United States a road engine without a truck is almost unheard of, and it is only in recent years that a pony truck has been considered altogether safe for high speeds, and yet it would be difficult to produce an authenticated instance of a derailment of an engine due solely to the absence of a truck. It will be noticed that, in this English engine, the wheels are placed well to the front and rear, with a long wheel base of 16 ft. 6 in. This arrangement is possible with inside cylinders and would be quite out of the question were they to be upon the outside. With the long wheel base and the reduction of the overhang that is characteristic of American locomotives, the tendency of the machine to teeter or gallop is reduced to a minimum and the liability to



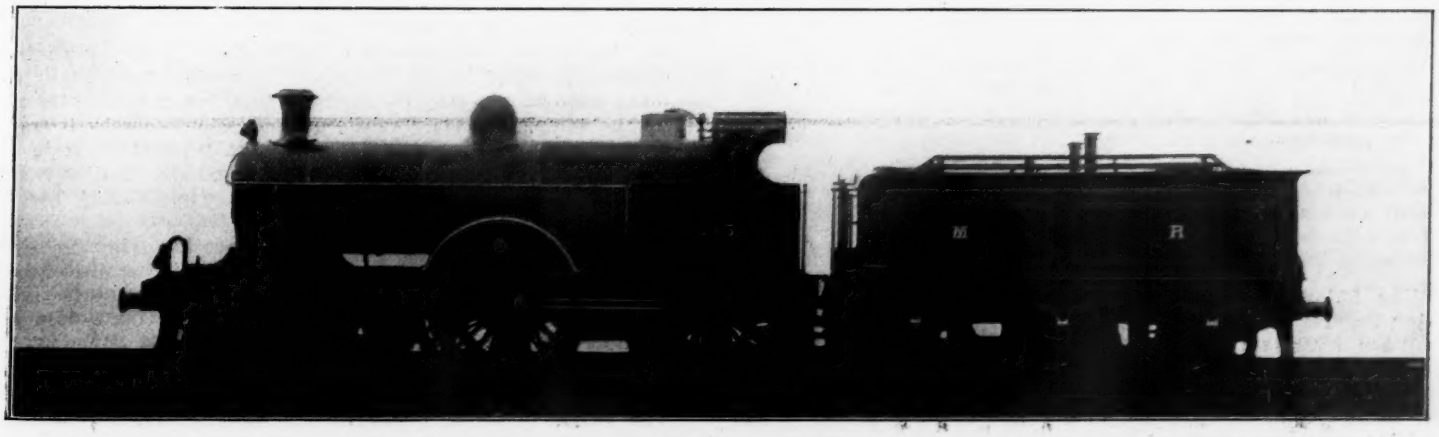
Inside Connected 6-Coupled Goods Locomotive; Midland Railway.



Three Cylinder Compound Express Locomotive; Midland Railway.



Three Cylinder Compound Express Passenger Locomotive; Midland Railway.



Inside Connected Express Passenger Locomotive; Midland Railway.

derailment cut down accordingly. So that it would seem that the danger arising from the absence of a truck is not due so much to that absence as it is to the location of the other wheels.

This engine, like the other simple engine illustrated (No. 845) has inside cylinders, and is possessed of the same general characteristics. A comparison of the weights upon drivers of all of these engines shows a variation between those of the same engine due to the lack of equalization. Take, for example, the 4-4-0 passenger engine No. 845. The weight on the front drivers empty is 38,528 lbs. and that on the rear is 34,664 lbs. These are increased to 41,356 lbs. and 37,968 lbs. respectively when the boilers are filled with water, showing an increase of 2,828 lbs. for the front and 3,304 lbs. for the rear wheels, the greater increase on the latter being due to their location beneath the firebox. This variation in the load and the lack of distribution of blows that are received in running over inequalities of the track must put an excessive stress at times upon the springs of the wheels that are required to momentarily sustain it.

The amount of this variation in the static load on the drivers of the four engines under consideration is shown in the following table:

Engine No.		Weight on drivers—Front.	Intermediate.	Rear.
845	Empty	38,528 lbs.	.....	34,664 lbs.
845	Working order	41,356 "	.....	37,968 "
2632	Empty	40,740 "	.....	38,080 "
2632	Working order	43,680 "	.....	41,776 "
1000	Empty	40,432 "	.....	40,768 "
1000	Working order	43,792 "	.....	43,792 "
2736	Empty	27,132 "	34,244 lbs.	26,964 "
2736	Working order	30,856 "	37,856 "	29,428 "

This variation is here especially noticeable in the case of the six-coupled goods locomotive where there is a difference of 8,428 lbs. in the weights on the main and rear drivers, a difference many times greater than that existing between the two trucks of the Baltimore & Ohio Mallet compound.

A resume of the principal dimensions of these Midland engines is given in the following table:

	Engines—No. 845.	No. 2632.	No. 1000.	No. 2736.
H. p. cylinder, diameter	19½ in.	19 in.	19 in.	18 in.
L. p. cylinder, diameter	.....	21 in.	21 in.	.....
Ratio, h.p. to l.p. cylinders.	.....	2.56	2.56	.....
Piston stroke	26 in.	26 in.	26 in.	26 in.
Steam pressure	180 lbs.	195 lbs.	220 lbs.	175 lbs.
Heating surface, tubes	1,383 sq. ft.	1,448 sq. ft.	1,305.5 sq. ft.	1,302.9 sq. ft.
" " firebox	145 "	150 "	152.8 "	125.0 "
" " total	1,528 "	1,598 "	1,458.3 "	1,427.9 "
Grate area	25 "	26 "	28.4 "	21.1 "
Weight, empty	108,416 lbs.	120,400 lbs.	124,096 lbs.	88,340 lbs.
" loaded	118,496 "	131,040 "	133,952 "	98,140 "
" on drivers, empty.	73,192 "	78,820 "	81,200 "	88,340 "
" on drivers, loaded.	79,324 "	85,456 "	87,584 "	98,140 "
" eng. & tendr, light.	157,248 "	188,048 "	176,288 "	134,260 "
" eng. & tndr, loaded	211,232 "	248,640 "	230,048 "	181,500 "
Tank capacity, water	3,500 gals.	4,500 gals.	3,500 gals.	3,500 gals.
Tank capacity, coal	4 tons.	5 tons.	7 tons.	4 tons.
Wheel base, rigid	9 ft. 6 in.	9 ft. 6 in.	9 ft. 6 in.	16 ft. 0 in.
" " total	23 " 5½ "	24 " 3 "	24 " 3 "	16 " 0 "
" " eng. & tendr.	46 " 0¼ "	51 " 8⅝ "	48 " 3¼ "	38 " 3¼ "
Total length, eng. & tendr.	54 " 11 "	60 " 10 "	57 " 2 "	50 " 3½ "
Tractive power:				
Per indicator	17,069 lbs.	19,040 lbs.	24,035 lbs.	18,032 lbs.
Midland formula	17,087 "	18,780 "	23,542 "	18,049 "
U. S. formula	18,674 "	20,083 "	24,401 "	19,888 "
Wheels, diameter, truck	39½ in.	42½ in.	42½ in.	.....
" " driving	81 "	84 "	84 "	63 in.
" " tender	51 "	42 "	51 "	51 "
Weight on drivers / Tractive effort*	4.25	4.25	3.59	4.94
Total weight / Tractive effort	6.35	6.52	5.49	4.94
Tractive eff. x diam. drvrs / Heating surface	989.85	1,055.68	1,405.53	877.48
Heating surface / Grate area	61.20	61.45	51.35	67.67
Firebox heating surface / Total heating surface	0.095	0.094	0.105	0.087
Weight on drivers / Heating surface	51.91	53.48	60.06	68.73
Total weight / Heating surface	77.48	82.00	91.86	.....

*The figures used for tractive effort in all succeeding ratings are by the U. S. formula, and weights are loaded weights.

April Railroad Law.

The following abstracts cover cases in railroad law decided by the Federal courts in April:

When interstate rates are established.—Rates are established when a schedule thereof is filed by the carrier with the Interstate Commerce Commission and copies are furnished by the railroad company to its freight offices, although the rates are not "posted." The provision requiring "posting" does not make this a condition precedent to the establishment of the rate. Its object is to afford special facilities to the public for ascertaining the rates in force. Texas & Pacific vs. Cisco Oil Mill, 27 Sup. Ct. 358.

Interstate shipments.—The bare intention of the owner of an interstate shipment of a car from the original terminal point to another point in the same state over the line of a connecting carrier does not make this later transportation interstate, and as such beyond the control of the railroad commission of the state in which this transportation occurs. Gulf, Colorado & Santa Fe vs. Texas, 27 Sup. Ct. 361.

Invitation to alight.—The simple announcement of the next station by a porter on a train, though made on the near approach to the station, is not an invitation to a passenger to leave his seat and attempt to alight before the train actually stops. Where this is done and an injury results the passenger is barred of a recovery against the railroad company by reason of his contributory negligence. Illinois Central vs. Warren, 149 Fed. Rep. 658.

Inequality in taxation.—State taxes will not be enjoined by the Federal courts on the ground of discrimination because of undervaluation of the other taxable property of the state unless the inequality is shown to be the result of a scheme or agreement among the taxing officers. Chicago, Burlington & Quincy Railway Co. vs. Babcock, 27 Sup. Ct. Rep. 326.

Consideration for limitation of liability.—A clause in a bill of lading exempting a carrier of goods from liability for loss by fire is valid though no concession in the rate was granted the shipper and no option was given him to receive any other form of bill of lading. Arthur vs. Texas & Pacific, 27 Sup. Ct. Rep. 338.

Shipper's right to relief from excessive rates in state courts.—A shipper cannot immediately invoke the aid of a state court to obtain relief from an unreasonable freight rate on an interstate rate where the rate complained of has been filed with the Interstate Commerce Commission and promulgated as provided by law. Until changed as provided by the act it is the duty of the carrier to enforce the rate against the shipper. The only wrongs that can be righted by any independent action or suit are those that cannot be corrected by the commission in the method and under the procedure laid down in the statute. Texas & Pacific vs. Abilene Cotton Oil Co., 27 Sup. Ct. Rep. 350.

Foreclosure of mortgage.—A strict compliance with the provision of a railroad mortgage requiring a request to the trustee by the holders of a majority in amount of the bonds secured and tender of indemnity against liability for costs as a condition to the suit for foreclosure is not required where it appears that a compliance is impossible and the trustee is antagonistic to the foreclosure by reason of interest in a second mortgage. Cochran vs. Pittsburg, Shawmut & Northern, 150 Fed. Rep. 682.

Consolidation or merger.—The Circuit Court of South Carolina in a case involving the status of the Atlantic Coast Line Railroad Company points out that there is a marked distinction between a consolidation and a merger of the two railroad companies. It is this: in a consolidation both companies go out of existence as separate corporations and a new corporation is created which takes their place and property. In the case of a merger, however, one company loses its identity by absorption in the other which remains in existence and succeeds to its property and issues its own stock to the stockholders of the merged company. Lee vs. Atlantic Coast Line Railroad Company, 150 Fed. Rep. 775.

Right to enjoin scalping.—The Circuit Court for the Northern district of Illinois holds that a railroad company has a present property interest in the right to issue special non-transferable tickets and have them maintained as non-transferable, whether such tickets are already issued or are to be issued from time to time in the future as its business or the needs of the public may require. Having this interest it may protect it by the use of the writ of injunction against scalpers, since the company is without an adequate legal remedy. Pennsylvania Railroad Co. vs. Bay, 150 Fed. Rep. 770.

Automatic couplers.—A shovel car is a car within the meaning of the Federal statute requiring cars used in moving interstate traffic to be equipped with automatic couplers. Schlemmer vs. Buffalo, Rochester & Pittsburg, 27 Sup. Ct. Rep. 407.

Indictment for giving rebates.—The offense of granting a rebate is sufficiently covered by an averment in the indictment that the defendant railroad company received the legal rate and granted and paid to the shipper a certain rebate or concession whereby it transported the property shipped at less than the legal rate. It is unnecessary to allege a prior agreement for the rebate. United States vs. Chicago, St. Paul, Minneapolis & Omaha, Sup. Ct. Rep. 84. Rep. 84.

Right of alien to sue for death.—In a case involving the right of an alien to recover for the death of a relative in a railroad accident the Circuit Court of Pennsylvania holds that the statute giving the right of action—and it is a purely statutory right—does not confer the right on a non-resident alien. Zeiger vs. Pennsylvania Railroad Co., 151 Fed. Rep. 348.

The Paris, Lyons & Mediterranean Railroad is to renew the track on its lines of heaviest traffic with rails weighing 94 lbs. a yard, and with cross-ties nearer together than heretofore.

Track Deformations and Their Prevention.*†

BY G. CUENOT,
Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

XI.

METHODS FOR REMEDYING TRACK DEFORMATION.

After having studied the principal deformations to which the track is submitted, it is proper to summarize the causes which have produced them and to search for methods to remedy them.

We have seen that the deformations consist of the creeping of the track, the reduction in gage of the track, or its spreading, the compression of the supports, the extraction of the screw spikes, which contributes to the vertical deformation of the rails, and finally of the shock, which is produced right at the joint, and which renders the latter the worst point in the track. We have set aside in this enumeration, which is not necessarily complete, the sliding of the track, which is exercised in a peculiar manner, and has no relation with the deformations in question. The latter, as also those we have pointed out, are due to two principal causes: the flexure of the tie and the longitudinal movement of the track, this last movement being itself a function of the flexure. Recapitulating, it is, therefore, the reduction of the effect of these two causes to which all specialists should bend their efforts. But, before examining in detail the proper means for diminishing the importance of this effect, it is necessary to give an account of the manner in which the tie rests on the ballast, because its position in the ballast ought to fix the tamped bed which should be made, and the length to give to it.

DEFORMATION OF THE ROADBED.

It follows from numerous statements which we have worked out that the tie, however well tamped it may be, and of whatever length, gives, at the end of a certain time after the passage of trains, the same form of flexure to the ballast which it experiences (see Figs. 30, 31 and 32). This flexure we have made known above; it is either, if the tie is long (more than 7.54 ft.), a concave curve with light swelling in the center, or else, if the tie is short (less than 6.88 ft.), a convex curve. This deformation of the ballast is not, as has been thought, an elastic deformation, but entirely permanent, which remains when the cause which produced it has ceased.

The ballast, in spite of all contrary appearances, is not elastic; it subsides successively and little by little under the passage of vehicles. This subsidence is variable according to the nature of the ballast and the state of the subsoil, and amounts to 1.18 or 1.57 in. when it is a question of gravel and a subgrade capable of deformation (embankment and cut argillaceous), and some millimeters only, when the ballast is composed of broken stone, and when the subgrade resists more completely. Thus it would seem that the track ought to descend, and by appreciable quantities; it is not so, happily, and at the end of a certain time a sort of equilibrium is produced; the tie becomes suspended above the ballast when it is not submitted to any load; it reposes on its extremities, whatever may be the care used in the tamping, and inflects in the void existing between the upper part of the ballast and its lower face, a void which arises from the subsidence of the support under the load. This observation, which I have made many times, and which is of great importance, as we shall see further along, has likewise been registered by Mr. Coüard (paper of July, 1897, on the vertical deformation of rails). One reads, in fact, on page 36 of this interesting article, the following conclusion of the causes of the vertical deformation of rails. "It is necessary to conclude that the ties fixed to the rail rest on certain points suspended above the ballast, and that right at the rail there are formed under the ties, even the best tamped, depressions in the ballast, on the edges of which the tie is supported; under the passage of a wheel even lightly loaded, the ties make contact with the ballast and inflect to the bottom of the depressions; from this moment only the increase of the bending is proportional to the load."

POSITION OF THE TIE IN THE TRACK.

The tie thus takes an appreciable flexure, which produces the dislocation of the joint and the deformation of the rail, and this flexure is due, in the ordinary case, to its excessive length, and to the unequal distribution of the pressure on the ballast, which is a consequence of it. The elasticity, which it is believed should be attributed to the ballast, and which is so construed from the fact that the tie returns nearly to the place which it occupied before the passage of the load, depends upon the bent tie itself and on the reaction of the roadbed. It is possible that the tie does not always rest on its extremities, but that it is supported on its central part, which is the case with center bound ties; that is to say with those which oscillate about their center, and which render the track unstable; this is produced when the tie meets a resistance at its center superior to that at its extremities, which is due either to the inequalities in the roadbed, or to the shocks arising from the vertical deformation of the rails, which unwedge the tie and remove the extremities from support.

The way ballast behaves under pressure leads to consequences which should be fully understood, and which explain the poor stability of certain tracks. Long ties have often been preferred because they could be shifted endwise and re-employed after adzing; that is a very bad practice, which it is necessary to abandon definitely. The ties rest, as has been seen, on their extremities; the longest by reason of their flexure on the one hand, and by the unequal distribution of the load on the ballast on the other are situated at a higher level than that of the shorter ties, when, after the passage of vehicles, they have returned to their initial position. For the compression of ballast is as much greater as the point considered is brought nearer to the point of application of the load, in the particular case of the rail. This explains why ties of unequal length succeeding each other in the track are of different heights, and produce a track in the form of a mountain, with high points and low points. The track becomes jolty; the rails present inequalities prejudicial to their good stability, and that effect is the more sensible the greater the speed.

But the same principle does not hold with ties of different cross sections. Under the load they descend unequally in the track, but these inequalities should be restricted in comparison with the first, because the longitudinal deformation of the tie is greater than its sinking. From a long tie resting suspended on its extremities, it follows that, in the experiments which we have made, the wood ties ought to be found, after the passage of a certain number of trains, at a higher level than that of the composite ties. This circumstance, which is perfectly explained, has nothing mischievous in it, since the whole track is displaced parallel to itself. But inequalities may occur at the passage from the composite ties to the ordinary ties.

EFFECT OF CLIMATIC VARIATIONS ON THE TIE.

The fact that the ties rest on the end, as has been proved, is also confirmed by the manner in which they behave on a very wet subsoil, or, on the contrary, on a very dry support. When the roadbed is argillaceous, it is known that it rapidly becomes muddy; the water is arrested on its surface and rises, especially in the central part, with the mud which it induces. The ballast becomes dirty, and the tie pumps because it rests on a muddy bed, which has, little by little, replaced the ballast buried in the roadbed. One of the methods for arresting this movement and this pumping consists in the establishment of walls at the extremities of the ties; the central part of the track is thus consolidated, the water remains in its interior, but the tie no longer pumps, because it is carried on a firmer soil, and because it no longer has the tendency to be supported on the less solid part, in consequence of its greater flexure. This method amounts to diminishing its length by increasing the points of support.

In the same way, when the variations of temperature are produced, the loaded tie modifies of itself its bed. When the ballast and the roadbed are very wet it spreads and assumes a longer bed; on the contrary, when the support becomes dry, the tie rises, so to speak, above its original axis. It takes a smaller bed, inferior to that which its length would permit.

This arises from the manner in which the load is distributed over a given surface, and the fact pointed out is the particular explanation of a more general law. The zone of influence of a load is of much greater extent, as the surface submitted to that influence is more capable of deformation. It is, consequently, of small extent when the support is rigid, and extends further when the latter is flexible. The disadvantage of these variations, for the subject which now occupies us, is that the flexure of ties increases with the deformation of the support; in order to do well it would then be necessary to eliminate the hygrometric and spongy ballast, and consolidate the roadbeds susceptible of notable deformation.

Recapitulating, it can be said that the tie, such as actually exists, is an elastic material resting on a support subject to deformation (the ballast), very little elastic (the roadbed). Its slight rigidity causes it not to rest on its whole length, and to distribute unequally the pressure on its support, the parts nearest to the load being submitted to a severer compression, that is to say, to a greater deformation. This deformation subsists by reason of the feeble elasticity of the roadbed, and at the end of a short time the tie rests on its extremities; it is a well understood question of a tie well tamped at the moment of laying, and established upon a roadbed of uniform resistance.

TAMPING.

Here naturally arises the problem of tamping the tie; on that question engineers are divided, because they have not perhaps analyzed in a sufficient manner the given data of the problem. How many times have I heard asked of the heads of sections the length which they desired, in order to make the track solid? And how many different replies have I heard, to the effect that the problem appeared unsolvable, so that each section foreman was allowed to make his own rules!

As a matter of fact, this does not make any trouble under actual

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†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

condition; all the tamped beds, whatever they be, lead to the same result; the tie always rests on its extremities. It is necessary, however, to guard against a tamped bed over the whole length of the tie, because it might cause its unwedging and make it center bound.

But the actual situation can be remedied, and in a general manner; it is not necessary to seek the length of the tamped bed for a tie whatever it be, that is to say the length of its bed intended to distribute the pressure as uniformly as possible over the ballast, and to prevent consequently its deformation, but—what is quite a different matter—the length of the tie should be studied, in order that it may undergo the least flexure. The first problem, such as is proposed, is unsolvable; the second, we have seen, offers a very clear and very precise solution. The length of the tie of least flexure being determined by experiment, nothing is more simple than to ascertain the best length for the tamped bed. Thus it has been found that the tie ought to have a length between 7.05 ft. and 7.22 ft.; the tamped bed will have a total length equal to twice the breech of the tie. The whole is symmetrical in comparison with the load, and consequently the pressure will be distributed nearly uniformly over the support. It would be mischievous to extend the tamped bed on the side of the center, because the tie would be deformed in an unequal manner, as we have seen.

LENGTH OF TIE OF LEAST FLEXURE.

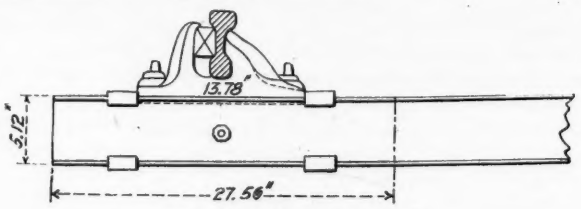
An objection can be put forth against the shortening of the tie on account of the obligation to avoid the cracks which are produced at the extremities in consequence of the introduction of the screw spikes. This useless length, it has been said, is a necessary evil; I do not think so, for, if the theory of the tie of least flexure is admitted as exact, nothing prevents consolidating the extremities with a special shoe, or a screw spike, as is done by certain French companies, the Eastern, for example.

But that is not all, and if it is desired to reduce the deformation to its minimum, which is necessary in order to allow an increase of speed, it is also necessary to have recourse to the measure extolled since 1897 by Mr. Coüard. That is to say, it is necessary to give to the tie the highest possible moment of resistance; that

COMPOSITE TIES.

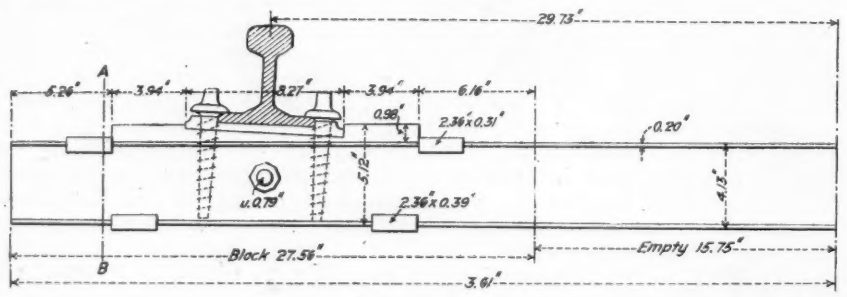
The experimental composite tie, which has behaved in an absolutely satisfactory manner, is not perhaps the only model of this kind which could be conceived. Made with a metallic skeleton, which gives to it a great rigidity, which is to be desired, containing two wooden blocks, on which the fastening is made, and which distribute the pressure on the roadbed, it presents all the advantages which one could wish: rigidity and simplicity. No rivets, no bolts; the compression of the two materials is obtained by clamping the skeleton by means of metallic cross bars. It is true that the price of such a tie is high, and that it could not be commonly employed; on tracks of much traffic this objection would not have great value. The security of traffic, the economy of maintenance by the reduction of deformation remain to be put in the balance with a higher cost price.

But one of the inventors, Mr. Michel, understood how well founded this objection could be for lines of less frequent traffic, and has designed another type of tie, constituted with the same materials, wood and steel, but formed of more simple elements. The metallic parts are formed of two pieces of channel iron, containing between them two wooden blocks in the form of a parallelopiped. The assemblage is made by means of four cross bars per block. The new model allows the realization of a series of types of resistance, diverse and, consequently, of variable price, according to the resistance. (Figs. 33, 34 and 35.)



Track with Double Head.

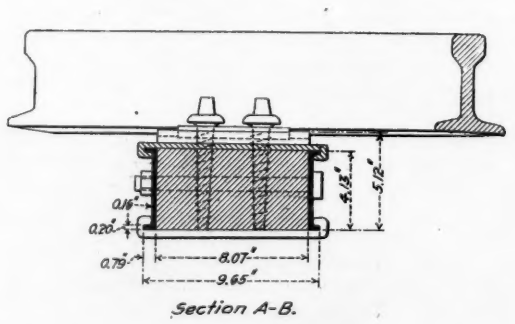
Fig. 34.



Half Elevation (U Iron)

Composite Tie. Michel System.

Fig. 33.



Section A-B.

Fig. 35.

of the wood tie, brought to the standard of the steel, is only 36, while that of the composite tie reaches 87, and is never less than 60.

The experiments which we have made naturally condemn all steel ties in the form of a trough; for, on the one hand, their resisting moment, less than that of the wood ties (30) is too weak, and on the other hand, the tamped bed is almost impossible to make, even with reduced dimensions which would lead to a less deformation. The moment of resistance could only be increased in two ways, and neither is practically capable of realization; it would be necessary either to increase the thickness of the metal, and then the tie, already too costly, would have a prohibitive price, or else it would be necessary to increase its depth, and the inconvenience of a bad tamped bed would be still more noticeable. Ties in the form of a trough should, therefore, be abandoned, and their general use would be an error, which would be regretted in the future. I am not referring to the reduction in gage of the track produced in consequence of the permanent flexure by the tie, nor of the fastenings, which certainly constitute a weak point, but confine myself simply to the defect of rigidity of this type, and to the difficulty of tamping.

The reduction of the flexure of ties is actually a necessity; it will correspond also to a reduction in the longitudinal movement, and will diminish the deformations which we have pointed out. The study which I have made with composite ties compared with ordinary ties confirms this view. The transverse flexure is diminished at the same time as the longitudinal movement, which produces the disorganization of the splices. These facts do not require explanation; it is certain that the increase of the bending moment ought to lead to a less deformation of the track, and that experiment has confirmed what theory has presaged for a long time. It has also been possible to establish, thanks to the composite tie, that there was a length of tie of which the deformation was minimum, and that the more general problem of the zone of influence of a load resting across a support on a material capable of deformation has been set forth.

The tie thus made presents the same advantages as the first one experimented with, rigidity and facility for compactness of the attachment, but it does not rest absolutely on the same principles. The squeezing was obtained, at least in the first conception of the inventors, by the rising of the wedge; in this case, on the contrary, it becomes perfect, as soon as the beam is formed, because the cross bars make the elements, wood and steel, which compose it, act jointly. This tie is not open to the charge that it has the grave defect of comprising a great number of pieces, for it is an armored beam, which only exists after the assemblage is effectuated. It would be possible to make the same criticism of an armored cement beam, or, indeed, even against a compound beam; both are created only when their elements are reunited. The tie in question is definitely an armored wooden beam.

The assemblage can be made with the perfection and solidity which it is proposed to have for it, as was shown in experiments undertaken at the laboratory of the Ecole des Ponts et Chaussées. The tie submitted to the test was composed of two pieces of channel iron, 5.51 in. deep, 0.20 in. thickness of web and 11.42 in. width of flange, bound together with cross bars of 2.36 in. by 3.94 in. Each of the oak blocks creosoted, at least superficially, was 27.56 in. long, 5.51 in. deep and 8.27 in. wide. The assemblage of the elements was made by placing the girdle constituted of channel iron against the wood, and by introducing the cross bars between the flanges of the channels by force. This procedure of squeezing was primitive, since it was arranged only by primitive means.

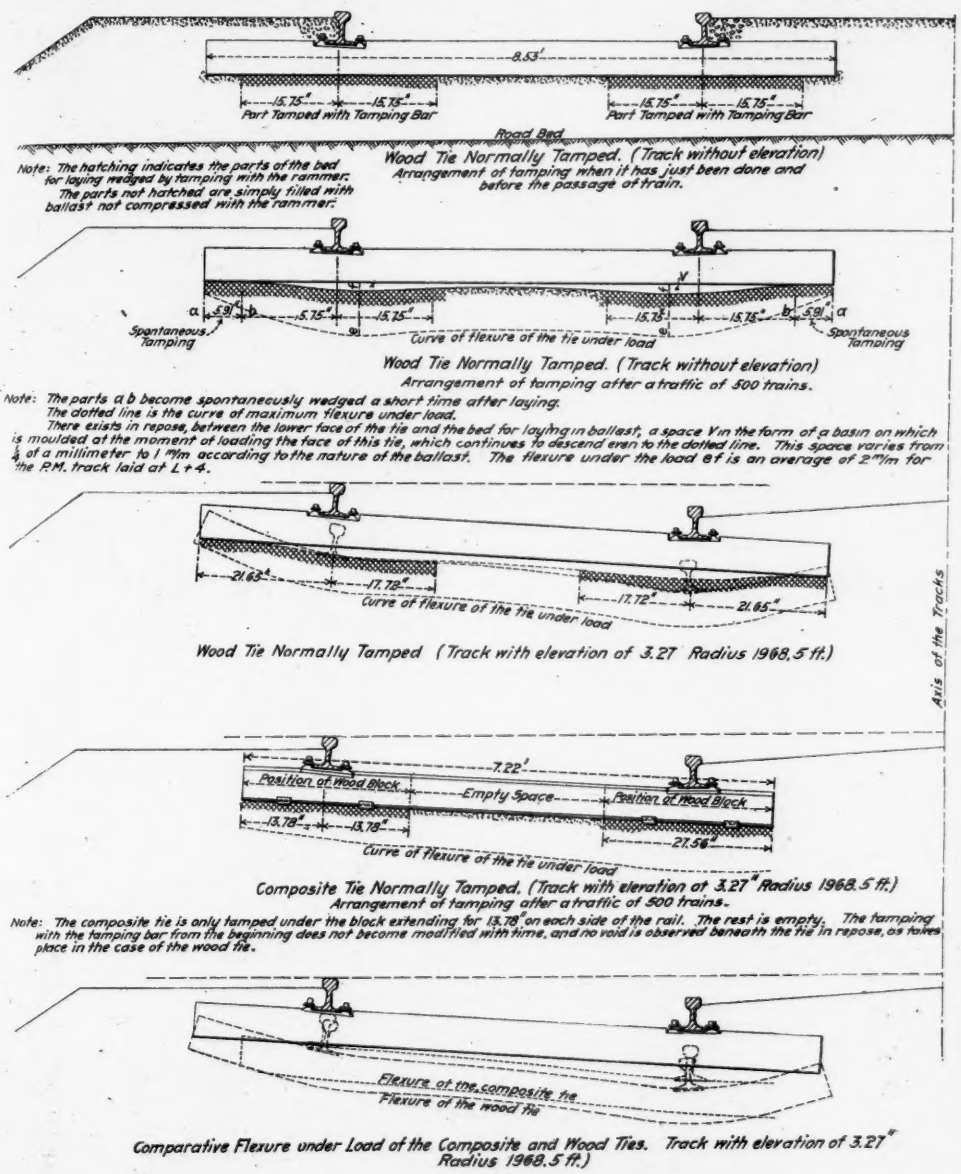
Nevertheless, it was sufficient, since the sliding of the piece of wood along the metallic body required a force of 8.8 net tons. The pressure obtained under the action of four clamps being 13.2 net tons, the coefficient of friction of wood against the iron was 0.3. The dislocation of such a beam is therefore not to be feared, and it is well to remark that under a similar force the wood tie would be either broken or near breaking, and that the steel tie would be on the point of bending (flexure of 0.91 in.).

But the assemblage can be assured by a methodical pressure,

and the above limit may be exceeded, if necessary. The pieces to be united will be placed under a press, and the heated cross bars will be introduced between the flanges of the channels; there will thus be realized, if it is desired, a total pressure of 39.6 net tons, which supposes a tension of 9.9 net tons per cross bar. Each of them having a section of 0.93 sq. in. would not be stressed to more than 21,334 lbs. per sq. in., which is acceptable. As to the wood, it would only be stressed to 526 lbs. per sq. in., about one-tenth of the breaking load.

It may be asked if the pressure, being obtained, will be maintained in spite of the effects of variations of temperature. I cannot cite experiments with figures for support; however, I will cite the first ties, which, placed in the track for four years, and submitted in consequence to all the temperature changes, have behaved well with a total pressure less than that which has since been realized. No yielding has been produced, and the central wedge could never be raised, except for a few millimeters. The proof has then been made experimentally that yielding is not possible under the conditions of test; but I do not wish to limit myself to this demonstration, and I am having executed at this moment a set of experiments relative to the effect of temperature variations on the clamping of beams made like the ties.

There is another point which I am having studied at the same time, and which deserves special mention. It is the hardening of the material by the effect of compression, a hardening which will diminish the sinking of the rail in its support, and consequently the deformation of the track and the stress on the fastenings. It is a general law; the compression of the material gives a resistance to it which it has not in a natural state. Mr. Considère, in a note inserted in the *Annales des Ponts et Chaussées* (second quarter of 1904), has shown that the resistance of cement was increased in the proportion of 1 to 6. The same fact should exist with wood; it is fitting to establish it, and to show every advantage which can be derived from it. It is probable that, thanks to this hardening, the fastenings will present a greater resistance and that they can be submitted to greater forces.


8.53'
15.75"
15.75"
Part Tamped with Tamping Bar
Road Bed
Wood Tie Normally Tamped. (Track without elevation)
Arrangement of tamping when it has just been done and before the passage of train.
Note: The hatching indicates the parts of the bed for laying wedged by tamping with the rammer. The parts not hatched are simply filled with ballast not compressed with the rammer.
Spontaneous Tamping
Curve of flexure of the tie under load
Wood Tie Normally Tamped. (Track without elevation)
Arrangement of tamping after a traffic of 500 trains.
Note: The parts a b become spontaneously wedged a short time after laying. The dotted line is the curve of maximum flexure under load. There exists in repose, between the lower face of the tie and the bed for laying in ballast, a space V in the form of a basin on which is moulded at the moment of loading the face of this tie, which continues to descend even to the dotted line. This space varies from ¼ of a millimeter to 1 m/m according to the nature of the ballast. The flexure under the load of 8t is an average of 2 m/m for the P.M. track laid at L+4.
21.65"
17.72"
Curve of flexure of the tie under load
Wood Tie Normally Tamped (Track with elevation of 3.27 Radius 1968.5 ft.)
Axis of the Tracks
7.22'
Position of Wood Block
Empty Space
13.78"
21.65"
Curve of flexure of the tie under load
Composite Tie Normally Tamped. (Track with elevation of 3.27" Radius 1968.5 ft.)
Arrangement of tamping after a traffic of 500 trains.
Note: The composite tie is only tamped under the block extending for 13.78" on each side of the rail. The rest is empty. The tamping with the tamping bar from the beginning does not become modified with time, and no void is observed beneath the tie in repose, as takes place in the case of the wood tie.
Flexure of the composite tie
Flexure of the wood tie
Comparative Flexure under Load of the Composite and Wood Ties. Track with elevation of 3.27" Radius 1968.5 ft.)

Figs. 30, 31 and 32.

The best wood, whether for ordinary ties or of blocks for composite ties, is heart oak. It is not necessary to creosote it; it is sufficient to use a coat of tar and lime to protect its upper face from the action of inclement weather. The experiment made on the tracks on the line from Mouchard to Bourg produced excellent results; it demonstrated that this treatment was successful in maintaining ties which would have been rejected with brief delay without the preservative. The latter does not prevent, at the end or on the sides, the slow and progressive seasoning of the tie.

The tie may also be seasoned by floating it for five or six months to eliminate elements of decay, but this process is long, and not very practicable because of the long drying subsequently required. If the oak contains sap, which is unfortunately very common, the floating can serve to preserve the beam; but creosoting is a disadvantage rather than an advantage. The sap alone absorbs the creosote in a sensible manner, and after the injection forms an impenetrable envelope, under the protection of which the sap, not being able to evaporate, enters into fermentation and attacks the wood. It is undoubtedly better not to creosote sap oak.

The same thing does not hold true for pine, spruce or beech. These woods season rapidly and are capable of absorbing a quantity of creosote sufficient to render antiseptic the small amount of sap which still remains after seasoning (about 20 per cent.). But it is necessary to creosote to refusal, which requires the employment of at least 55 lbs. of antiseptic liquid for a tie of 8.53 ft.; under these conditions the sap is, so to speak, surrounded by creosote, and any fermentation is impossible. With a smaller dose, the sap not being given immunity, enters into fermentation, and decay commences; this has been observed when the amount of creosote is reduced to 35½ lbs.

Besides these methods of preservation of ties, attention should be directed to the covering of their upper part by ballast, the employment of plates which protect the seat of the fastenings, and consequently the fastenings themselves. Perhaps it would be well, in the case of secondary companies, where the ties often perish by the fastenings and the decay of their sockets, to place in default of a plate, a hoop-iron shim, whose only purpose would be to cover the seat of the fastenings. On the P. L. M., notably, where a plate is employed, the decay of ties is scarcely produced, except in the central part. The fastenings are still good, except when they have undergone excessive turning, and then the tie ought to be rejected. This is not true on lines where the rail rests directly on the tie, and where the fastenings are absolutely uncovered; rust attacks the screw spike and the wood which surrounds it. The fastening becomes bad before the tie has become unfit for usage. From that arises the necessity for having recourse to a method for consolidation of the fastenings, which is not generally necessary on tracks provided with plates. It is the same in the case of the ties laid with even joints, for those of the following end, notably, often perish at their fastenings by reason of the hammering which they support at the joint. The wood in which the screw spike is engaged is torn, and the piece should be rejected. It holds that at the end of a certain time this piece is left in the air; the fastenings support the weight of the beam and finish by tearing the wood.

(To be continued.)

Hand Brakes and Their Use on Steep Grades.*

The committee finds that a large percentage of cars in service have inefficient hand-brakes. The percentage of brake power is too low, the construction is faulty and cars are not kept in repair. In mountain grade service hand-brakes are used a good deal, but where trainmen have to work fast, they do not set the brakes tight enough; they ought to allow a little time so the lost motion in the trucks can be taken up. The Interstate Commerce Commission, in its annual report, has referred to the neglected condition of hand-brakes, which is increasing since the general introduction of air-brakes. The percentage of hand-brake power on freight cars having

*Abstract of committee report to the Air Brake Association, at its annual convention, Columbus, Ohio, May 14; Mark Purcell, Chairman.

10-in. brake cylinders, and on all heavy passenger cars, should be at least 40 per cent. of the light weight of the car. The levers should be such that the hand-brakes will work in harmony with the air-brakes. In tests made with an air-brake instruction car on a mountain grade, when running at 50 miles an hour, it was found that the speed rose, after the brakeman began to apply the hand-brake, to 55 miles an hour, before the speed began to lessen; a fact indicating that when it is necessary to apply hand-brakes on a grade very prompt action should be taken. Testing with one car on a 2.2 per cent. grade, with a brake power of 27 per cent. of the weight of the car, the distance required to stop from a speed of 12 miles an hour was 1,200 ft.; from 40 miles an hour, 5,280 ft.; from 50 miles an hour, with 37.5 per cent. brake power, 3,600 ft. In these tests the pull on the hand-brake chain was 1,000 lbs., as shown by dynamometer tests. A train of a number of cars would not show so good results as this, as, in this case, force was applied to the brake wheel at frequent intervals throughout the stop.

Many passenger-car trains are found with hand-brakes which do not work in harmony with the air-brakes. In case it is desired to leave a train standing on a grade this is a dangerous condition. With such cars, to be safe, the air-brake should be bled while the hand-brakes are being set. With vestibule cars the old-fashioned brake wheel cannot be used, and a lever is necessary. The best type of lever is about 24 in. long and similar to the Lindstrum design.

Considering freight trains more in detail, the committee finds that on the average train with 8-in. air-brake cylinders the hand-brake power is about 11 per cent., which may be increased to 22 per cent. by using a club (length not stated), which, it is estimated, will double the power exerted by the brakeman. Even with the use of a club the hand-brake power on loaded cars with 10-in. air cylinders is only about 15 per cent. With 10-in. cylinders the rate of leverage for the hand-brake is reduced; hence it will be found that after 10-in. cylinders come into general use, the average hand-brake power available will decrease, unless the hand-brake rigging is changed.

The committee concludes with a recommendation that the best means of securing a higher standard for mountain service be discussed, for it is frequently difficult to handle trains on mountain grades by means of air alone.

Compression of Steel Ingots by Wire Drawing.*

Most of the physical defects in steel have their source in the process of solidification, which takes place in the ingot mould where the molten steel is allowed to cool into solid form before forging or rolling. In the cooling process the metal is affected by three injurious forces—contraction, crystalization and liquation or segregation. Many attempts have been made to overcome these injurious effects by using various forms and materials in making ingot moulds, by subjecting the solidifying ingots to compression by the Whitworth system and by other methods of subjecting the ingot to mechanical work. Of these the Whitworth system of compression during solidification has been, until recently, on the whole, the most satisfactory. At the steel works of St. Etienne in France a new process, known as the Harmet process, has recently been tried with remarkable results. Briefly, it consists of compressing the ingot during solidification by wire drawing. A tapered ingot mould is used, smaller at the top than at the bottom, and an hydraulic plunger, forming the bottom of the ingot mould, is forced upward, compressing the solidifying steel into the contracted volume at the top of the mould.

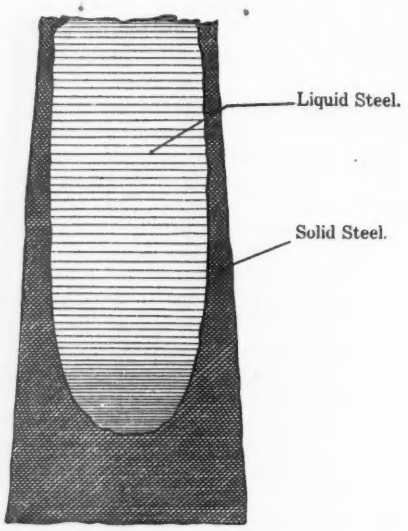


Fig. 1.

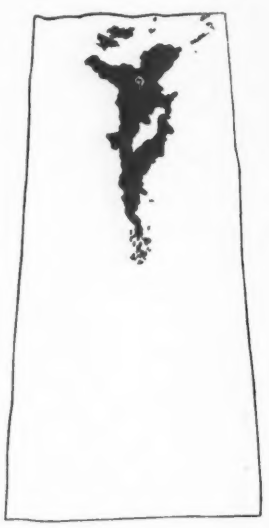


Fig.2.

In order to clearly understand the principle of the Harmet process it is necessary to briefly explain the action of the liquid steel in solidifying, when poured into the ordinary ingot mould. The steel, at a temperature of about 2,000 deg., comes in contact with the cold walls of the mould, and immediately solidifies in a thin shell containing a mass of liquid steel in the center, as shown in Fig. 1. Almost instantly this shell shrinks and separates from immediate contact with the walls of the mould. Little by little during cooling the liquid mass in the center becomes plastic and attaches itself progressively to the thin shell first formed, adding to its thickness. In the interior is left a hollow corresponding to the volume of shrinkage. If the ingot after cooling is divided through its vertical axis (see Fig. 2) a large cavity is found in the upper part, due to the metal flowing downward by its own weight to fill up the hollows left in the lower part due to shrinkage. Besides this, a hollow space is formed in the center itself after solidification, on account of the failure of the supply of liquid metal to fill the new cavities. These defects or "pipes" are usually visible to the naked eye throughout the whole of the upper half of the ingot, and under the microscope they can often be seen in the lower half. The steel in cooling, after solidification, contracts within itself and produces stresses and oftentimes small cracks and fissures, which it is impossible to detect with the naked eye. Proper subsequent reheating and working, however, almost entirely remove these defects.

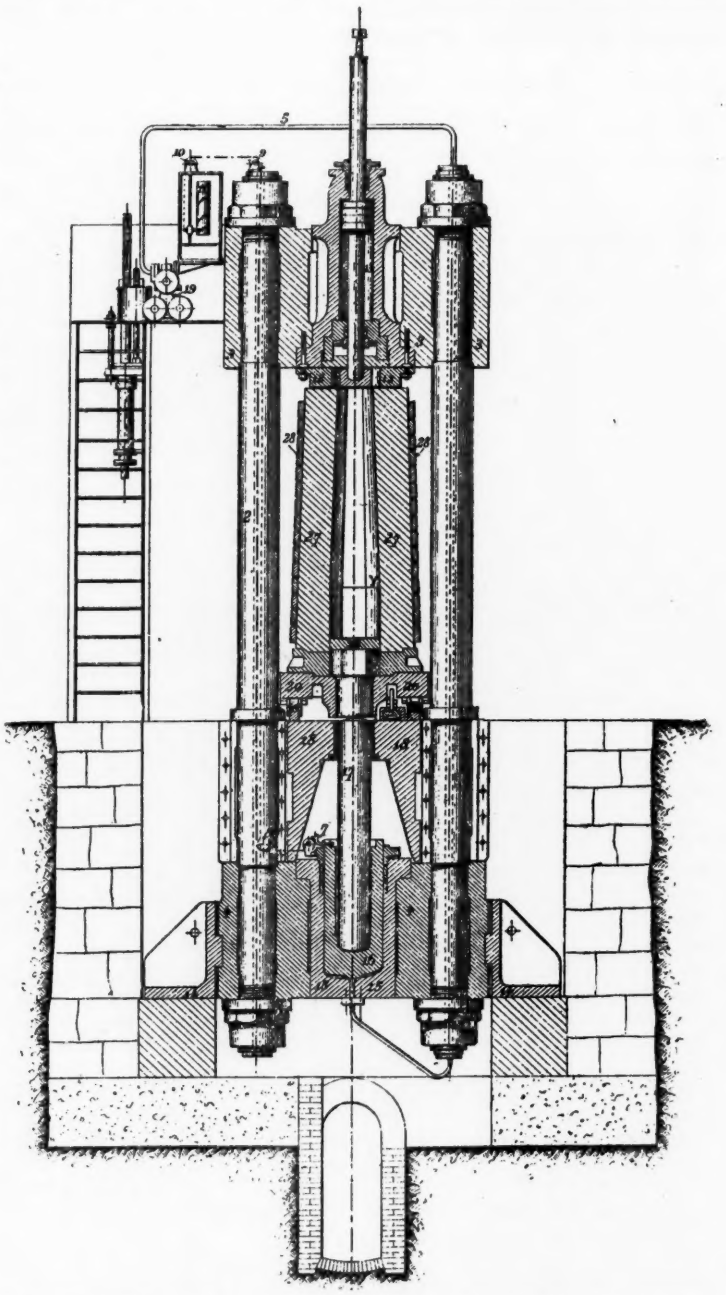


Fig. 3—Section Through Harmet Ingot Wiredrawing Machine.

The steel in solidifying crystalizes throughout its mass. These crystals have little cohesion between themselves, and when stresses, due to contraction within the metal, are set up, they offer low resistance and cracking occurs easily. The crystalization of the steel is promoted by any cause tending to delay the solidification, such

*An abstract of an article printed in the Journal of the United States Artillery, March, 1905, prepared from data furnished by Major E. L. Zalinski, U. S. A., retired, and reprinted here through the courtesy of Captain Andrew Hero, Jr., U. S. A., Editor of that journal.

as lining the upper part of the mould with refractory material, and also by the contraction of the ingot which separates from the cold wall of the mould. Except for the possibility of the development of internal cracks, due to contraction, the formation of crystals is not serious, for the structure of the steel can be much improved by subsequent annealing and forging processes.

The metalloids which enter into the composition of steel have a tendency to separate from the iron. The carbon is the most mobile, being attracted in turn towards the main fluid part of the mass, finally concentrating where solidification last takes place, that is, in the head of the ingot. Chemical analysis of an ordinary ingot will show from 10 to 20 per cent. more carbon in the head of the ingot than in the bottom and corresponding higher percentages of sulphur and phosphorous.

The combination of these three defects results in the fact that a steel, although absolutely perfect in the liquid state as regards chemical composition and quality, is, after cooling in the ingot mould, permeated with defects; the upper portion is affected with pipe, the whole mass is crystalized and seamed with cracks and torn by internal stresses, while the chemical composition is rendered irregular by segregation. The metal, in this state, is commercially useless, and mechanical treatment by rolling or forging must be relied on to correct, as far as possible, the defects which were allowed to occur during solidification. The upper end must be cropped, the cracks and fissures have to be rewelded, the internal stresses relieved and the crystalization broken up and reduced; the segregation, however, remains unaltered, and defects due to this cause can only be discovered later in tests on specimens taken after finishing the material.

The Whitworth process consists of compressing with a static pressure acting on the top of the ingot. In spite of the great pressure applied, the effect of it extends only to the exterior of the ingot, which in cooling rapidly forms a crust with the rigidity of a column and thus arrests the force applied, and protects the whole of the central part against the pressure from above. The Harmet process, as developed at St. Etienne, is designed, not so much to remedy the defects developed in the ingot as to forestall their development. We have seen that the formation of the pipe is due to the fact that the outer shell of the ingot is permanently fixed, and the subsequent shrinkage of the central mass, therefore, leaves hollows in the center. If this external shell is forced inwards on the central mass, and compelled to follow the shrinkage movement or even to close in at a rate somewhat quicker than that at which the volume diminishes, the formation of cavities and internal faults will be avoided. This is exactly the result attained by compression by wire drawing. The compression of the steel is applied to the whole surface of the ingot diminishing its volume by closing in all sides but the top on the central mass.

Fig. 4—Non-compressed Metal (Fissured).

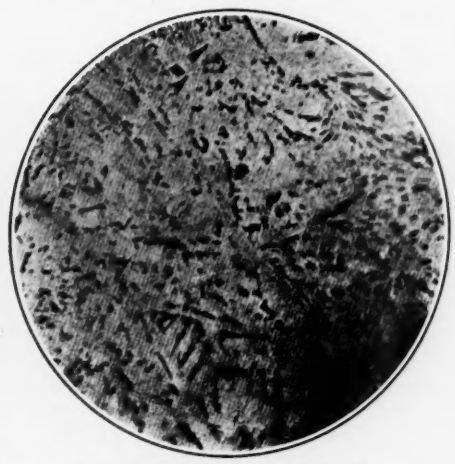


Fig. 5—Compressed Metal.

The defects, due to the formation of coarse crystals and to segregation, are due to retardation in cooling. Instantaneous solidification is, of course, impossible, and these defects cannot be completely overcome, but with the wire drawing process they can be greatly diminished for the following reasons:

(a) The ingot mould is a large mass of metal which rapidly absorbs a quantity of heat, and it is kept in constant contact with the solidifying ingot by the gradual advancement of the ingot under pressure from below.

(b) Steel contracts in passing into the solid state and pressure hastens the transition. This results in shortening the time of solidification and reduces the crystalization.

(c) Segregation is reduced because of the fact that as pressure is applied to the ingot from below the metal is forced upwards and comes in contact with the comparatively cool upper part of the mould. This tends to rapidly cool the top of the ingot and prevents segregation.

Fig. 3 shows the hydraulic compressing machine installed in the steel works at St. Etienne. The machine asserts a pressure of 1,200 tons and is suitable for compressing ingots weighing from five to six tons. It consists essentially of an upper head carrying the stripping cylinder and piston, and a lower head carrying the forging ram, the two being tied together with four large tie bolts. The car for carrying the ingot mould is made of cast-iron, and in the center is a movable plug which forms the bottom of the ingot mould. The car is run over the bottom head and securely locked in position when ready for compressing. The ingot mould is of cast-iron bound with hoops. The inner walls are straight at the bottom for about one-fourth of the height, and from there up are given a taper of 1 in 30. The upper end of the hydraulic plunger is made spherical so as to prevent the movable plug in the ingot car, which is being forced up through the mould, from tilting to one side. When the car with the mould containing the liquid steel is brought under the press, pressure is applied to the hydraulic ram, and the plug, forming the bottom of the mould, is gradually forced up into the mould. The rate of advance is slightly more rapid than the contraction of the cooling steel in order to compress the core of the ingot, but care is exercised not to allow the metal to flow over the top edge of the mould. The rate of advance of the plunger depends on the characteristics of the steel which is being handled, and is in practice determined experimentally by removing the stripping plunger and mounting a mirror at an angle of 45 deg. above the top of the ingot mould, so that the condition of the surface at the top of the ingot can be observed. The rate of advance is adjusted so as to keep the metal just even with the top of the mould, but not allowing it to overflow. This rate of advance is determined experimentally and recorded by an automatic device attached to the machine which registers the curve of plunger displacement; in subsequent workings the plunger is made to advance at a speed corresponding to the experimental curve obtained, the operator manipulating the pressure valves in such a way as to cause the indicator to exactly follow the curve already determined. The time required for compressing ingots varies with the size of the ingot. Small ingots, weighing about 120 kilograms, require at least eight minutes, and this time should be lengthened for best results to 10 minutes. Experiments showed that at the end of five or six minutes the metal was still pasty in the center, and that if the compression was stopped at that point small cavities would still be left in the center of the ingot. At the end of eight minutes solidification is compiete, and if the ingot was taken to the mill immediately on leaving the press and there treated physically it would give a perfect metal. However, if it is allowed to cool further after eight minutes of compression the ingot remains solid, but severe internal stresses are set up by subsequent shrinkage. At the end of 10 minutes absolute soundness in metal is assured, but even then it is preferable to work the ingot immediately on leaving the press and before it is allowed to cool further.

The results obtained from the process may be considered under two heads, commercial and scientific. It is claimed that the cost of the process is not much greater than that of the ordinary processes, and that the saving in crop ends from ingots is more than sufficient to make up for the slightly increased cost of compression. The French government specifies that uncompressed steel ingots shall have the top 28 per cent. cropped, but accepts ingots made by the Harmet process with 5 per cent. crop ends, a saving of 23 per cent. The process not only eliminates the defects due to contraction but effects a forging of the metal in the ingot, thus reducing the subsequent work in the rolling mill or under the hammer. Test pieces cut from compressed ingots without forging or rolling showed as good results under tensile and impact tests as test pieces cut from compressed ingots of the same composition which had been forged with a reduction of two times in the cross sectional area.

The physical results from the process are even more remarkable. The compression extends throughout the whole mass and give a sound metal thoroughly homogeneous in the very center of the ingot. There is a marked diminution of segregation, the chemical analyses at the top and bottom of the ingot being substantially the same. The compressed ingot has a grain of a visibly finer structure and the large cleavages, often found in sections cut from uncompressed ingots, are not found. The photographs reproduced herewith show the relative structure of the compressed and uncompressed ingots. The minute cracks, shown in the uncompressed ingot, constitute a starting point for rupture, and the unexpected failures of steel are often due to such small defects.

The Harmet process is employed commercially on a large scale at the steel works at St. Etienne, and the results obtained are most satisfactory. The compressed metal has been used with success for armor plates, projectiles, crank shafts, etc. The Ordnance Department of the United States Army has ordered for test in this country a 10-ton ingot, which will be used in making gun forgings. The process is used at Cammels' in England and Beardmore's Works at Glasgow, where there is an installation for compressing ingots weigh-

ing from 20 to 40 tons used in making armor plates; it has also been installed by John Brown & Company. As yet it has nowhere been introduced in the United States.

Proposed New Union Station at Toronto.

The Grand Trunk and the Canadian Pacific have recently completed plans for a new union station at Toronto, Canada. It will occupy a site close to the present station on a tract of land recently acquired to permit the necessary enlargement of present facilities to be made. The present union station buildings are situated between Simcoe and York streets, south of Station street. The new tract is an irregular area bounded on the west by York street, on the north by Front street, and on the south by Esplanade street, which latter will be closed as a thoroughfare west of Yonge street. The location of the closed portion, and therefore the southerly boundary of the new tract, is indicated by the light dotted lines which form a continuation of the unclosed portion shown at the easterly side of the general layout plan, and extend somewhat irregularly to a point just south of the junction of York and Station streets. The new tract extends east of Bay street to about the location of the proposed new street. The cost of the new station and grounds is estimated at about $2,000,000. The following description and accompanying plans were sent us by R. S. Logan, Assistant to the Second Vice-President of the Grand Trunk.

Proposed New Union Station at Toronto.

The proposed passenger station building, including baggage buildings and service plant, are to be erected on the southerly side of Front street, between York and Bay streets, and will occupy the entire frontage between these streets. The express building now existing west of York street will be retained for the express service of the Grand Trunk, and a new express building of similar dimensions and with the same general relation to the passenger building will be erected east of Bay street for the express service of the Canadian Pacific. The northerly line of the passenger buildings is to be generally 65 ft. from the southerly line of Front street, leaving a plaza of this width for carriage and foot walk purposes. The station building is generally 100 ft. wide, and between the building and the tracks there is a concourse 90 ft. wide for the general circulation of passengers.

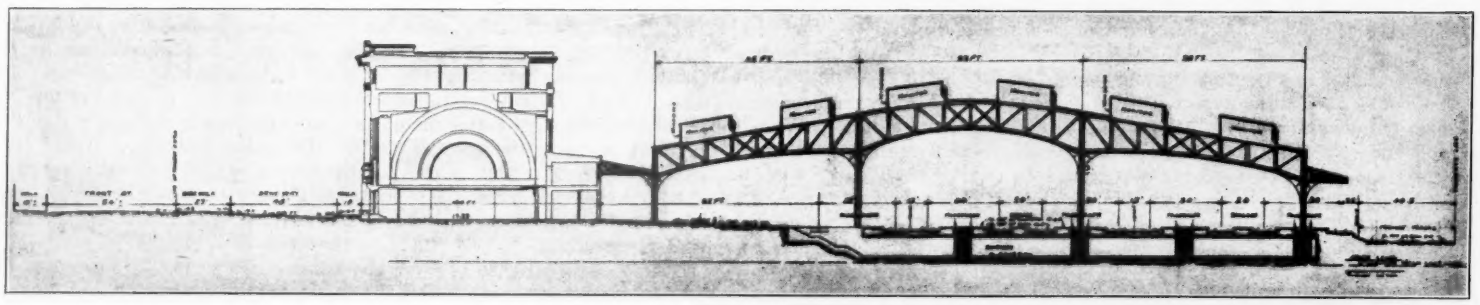
The track layout consists of nine through tracks and two stub tracks, so arranged that there are five platforms for passengers and two platforms for the exclusive trucking of baggage and express matter. The station tracks are connected up at each end with an interlocking switching system so that they properly join the four main tracks on the east and the two main tracks on the west, generally with double-track leads, to give the greatest facility to the train movements. The passenger platforms will be 1,400 ft. long, this distance being sufficient for the longest trains, though it may be increased if found necessary. They are about 20 ft. wide throughout.

The new tracks at a point opposite the center of the station will be 4 ft. higher than the present tracks, and the platforms are designed to be 8 in. above the top of the rail. This gives a difference of level of about 5 ft. between the grade of the platform and the grade of Front street, which difference is overcome by three steps at the waiting room entrance and inclined surfaces transversely on the concourse between the tracks and the station, and on the plaza between the station and Front street. None of the inclined surfaces exceed a slope of 3/8 in. per foot. The passages for exit are without any steps whatever. By this arrangement the station and platforms are, in effect, level with the street, a condition which permits of the best possible treatment of any type of a railroad station.

In order to accomplish this it has been found necessary to provide for the removal of the present York street overhead bridge and to substitute for it an overhead bridge just east of Bay street. It is also suggested that this latter bridge can be made to take care of the traffic at the Yonge street grade crossing, so that the necessity of a bridge at the latter street can be avoided. Foot bridges at any necessary point of crossing can be built without interfering with the raising of the tracks.

In order that it may not be necessary for any passenger to go upon any track at grade, and to make the station absolutely safe and fully up to modern methods and requirements, a subway 50 ft. wide is provided opposite the center of the station, so that any platform may be reached by means of easy stairways with landings. The total height of stairways for this purpose is about 10 ft. This method allows all trains to come to a stop directly opposite the center of the station, thus making the least distance for passengers to walk to and from the station and trains.

The baggage and express trucks are to be kept as much as possible on special trucking platforms, 10 ft. wide, which extend the whole length of the station and which are adjacent to four of the nine through tracks. On these four tracks it is intended that trains having the bulk of express and baggage matter will be run. The baggage and express trucks cross the track area by subways beneath the tracks and leading to the basement of the baggage and express buildings. The trucks will be raised and lowered between the subways and the platforms by means of electric elevators. There are three of these cross subways, one leading to the baggage room, one to the express building at the east end, and one to the express building at the west end of the station.

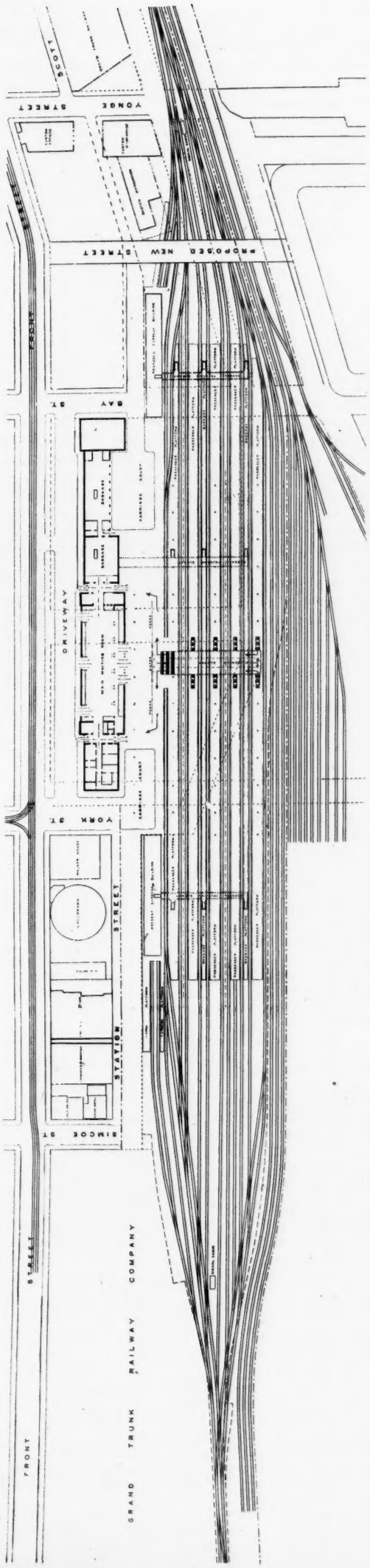


Section Through Main Waiting Room and Passenger Subway; Train Shed Construction; Toronto Union Station.

A train-shed roof will cover the main portion of the platforms and the concourse. It will be 800 ft. long by 315 ft. wide, covering about six acres. The main structure will be in three spans and there will be a connecting roof between the train shed and the station building. This roof will be a steel structure and will be lighted and ventilated.

At each end of the station concourse are spaces for a carriage court, for the accommodation of cabs, carriages and baggage transfer wagons, so that it will not be necessary to pass through the station building to get a carriage.

At the extreme easterly end of the station a service building is provided for supplying all heat, light, steam, hot water, compressed air, refrigeration, etc., for the use of the station building and trains.



Proposed General Layout; Toronto Union Station.

The general layout of the station yards and grounds, including the approach tracks, does not interfere in any way with the present freight yards of either railroad company.

The station building is planned primarily with a view to convenience and spaciousness, and consists of a main central building with two service wings. In the main building, on a level with the tracks, is located the general waiting room containing 17,242 sq. ft., which is 5,000 sq. ft. larger in area than the Grand Central Station of New York City, or the present station in Toronto. Access to the waiting room is obtained directly by three spacious openings containing nine doors each directly from the plaza, or Front street. Egress to the trains is obtained by three similar openings, containing each nine doors, leading to the concourse.

Ticket, telegraph and telephone booths, information bureau, news stands, ample parcel room and other conveniences are provided along the four sides of the waiting room, where they are easily accessible and visible.

A broad passage at the east end leads directly to the baggage room, which is located in the east service wing. The area of this room, including the basement and first floor, is 28,000 sq. ft., or 15,000 sq. ft. larger than the present baggage room, and 6,000 sq. ft. larger than the baggage room at the Grand Central Station of New York, which is one of the largest in the United States. A similar passage at the west end of the waiting room leads directly to the west service wing, in which are located waiting rooms for men and women, each provided with ample toilet accommodations, the women having in addition retiring rooms. Barber shop, boot blacks and other conveniences, together with a well-equipped, spacious lunch counter, are likewise provided in this section of the building.

Spacious passages running north and south are placed at each end of the waiting room, between the waiting room and the baggage room on the east, and between the waiting room and service wing just mentioned on the west. These passages are intended mainly for exits, so that the traveling public, in arriving, will pass through and out without crossing the waiting room. Passengers departing can enter by the east passage, check their baggage and buy their tickets without confusion or delay. Carriage courts both east and west of the main building are available for cab service. The east court is likewise available for transfer companies and baggage service.

It is especially to be noted that the main waiting room, as planned, cannot conveniently be used as a thoroughfare, which will increase its efficiency and comfort. This main waiting room extends to a height of three stories, and is lighted by 14 large windows, seven on the north and seven on the south. A gallery extends around all four sides of the room at the height of the second story of the service wings, the north gallery giving access to a series of roomy offices for the use of the employees directly in charge of the station traffic. On this floor in the west wing is a large dining room, serving rooms, kitchen and all accessories. In the east wing is a large hall for the segregation and handling of immigrants, with retiring rooms and toilet rooms for both sexes, and ample accommodations for the officers in charge of this service.

In the story extending over the entire waiting room and in the top or third story of the service wings, accommodations about 6,000 sq. ft. in excess of those existing in the present station in Toronto are provided for the general offices of both railroad companies. Two staircases, each with two elevators, are provided, one at the east and the other at the west end of the main waiting room, giving access to the galleries, offices and other service.

The architectural treatment of the exterior is designed with a view of obtaining a monumental effect in a simple, dignified and reposeful manner; of expressing clearly on the exterior the function of each part of the building on the interior. Thus, the main waiting room is clearly suggested by the large windows and the solid basement treatment, the wings indicating clearly the subordinate function which they have to perform; so likewise the baggage and service buildings. The treatment will be maintained on the interior of the building on the same lines. The style of architecture is classic, and though inspired as to detail from the fine examples of the eighteenth century, is treated so as to be distinctly modern in its expression and to clearly indicate the purpose of the building as a whole, and of each part of the building as well. It is intended to build the exterior of some light stone.

Air Brake Control on Heavy Grades of Trains Composed Exclusively of Fully Loaded 100,000 Lbs. Capacity Cars.*

This important problem has not yet been solved to the entire satisfaction of all concerned; or, if the problem has been solved, conditions have not been fully complied with. In the year 1906 and in the early part of the current year one of the large railroads set out to minimize the difficulties in handling heavy coal trains down 3 or 4 per cent. grades, and the writer was appointed a com-

*From a paper presented at the fourteenth annual convention of the Air-Brake Association, by T. L. Burton.

mittee of one to present to you the details of the results obtained in solving the problem.

The grade is 5½ miles long. The minimum grade is 173 ft., maximum 190. This grade is in the heart of the anthracite coal region, and traffic is extremely heavy. From the summit to the base the cars are dropped down by an engine and crew over a 3.4 per cent. grade in trains averaging 1,120 tons each. The yard at the summit is about one-half mile long, is small and narrow and congested. A train leaves the summit every 30 to 36 minutes (average). It has been the practice to control the speed of the trains by hand-brakes, but since the introduction of 100,000-lb. capacity cars difficulties have been encountered.

As a first means of precaution the air-brakes were coupled up upon 50 per cent. of the cars to be used in case of emergency with hand-brakes, but the results were not satisfactory. The next step was to couple up the air-brakes on all cars, the same to be used only in cases of emergency. This practice also failed to produce satisfactory results, and the brake pipe pressure was increased from 70 lbs. to 90 lbs. All engines were equipped with Westinghouse combined automatic and straight air-brakes. Rigid rules were enforced covering adjustment of piston travel on cars, but still the speed of the trains would get beyond the trainmen. While no wrecks occurred, the train could not always be stopped when desired, and accidents were averted only by having a clear track at the foot of the grade.

Owing to the heavy grade and severe conditions, the railroad officials did not feel safe in suddenly changing from the old practice of using both hand and air-brakes, unless they could first be referred to other roads on which conditions were equally severe. These officials desired to visit some place where trains of 1,100 tons, made up exclusively of 100,000-lb. capacity cars, sometimes loaded in excess of their rated capacity, were being handled down 3 to 4 per cent. grades without the assistance of hand-brakes, and a road having such conditions was looked for, but in vain. This was a surprise, especially in view of reports concerning the wonderful work of the railroads in the west.

* * * A trial trip was arranged to be made down the grade with a train of twenty 100,000-lb. capacity cars, loaded in excess of their capacity, and equipped with "K" triple valves, and with the Westinghouse Air-Brake Company's three-position (15-30 lbs.) retaining valves, the latter having been for some time standard on this road. The trial train was handled down the grade under the supervision of the writer, and under the personal observation of a number of the officials of the railroad and some visitors. The make-up of the train, condition of brakes and method of handling same were as follows: The locomotive was equipped with the Westinghouse Air-Brake Company's standard automatic brake, two 9½ in. pumps, plain triple valves on locomotive and tender, duplex pump governor, main reservoir of 73,000 cu. in. capacity, combined automatic and straight air-brake, and schedules SWA and SWB. The feed valve was adjusted to 90 lbs. brake-pipe pressure with the brake valve handle at running position, and 130 lbs. pressure with the brake valve handle on lap, or application position. The straight air-brake reducing valve and safety valves were adjusted to standard pressures of 45 and 53 lbs., respectively.

The steam pressure carried on the boiler was 155 lbs., and the weight of the locomotive and tender was 393,900 lbs.

Cars in train	20
Kind of cars	100,000 capacity, steel, coal
Average light weight, per car	41,855 lbs.
Total light weight of train	837,110 "
Average loaded weight per car	142,900 "
Total weight of train	1,429 tons or 2,858,000 "

The brake equipment was as follows:

Detached auxiliary reservoirs and cylinders, 10-in. and K-2 triple valves. Standard 15-30 lb. retaining valves, used in the 30 lb. position.

The braking power, based on 60 lbs. cylinder pressure, was as follows:

Braking power per car	35,820 lbs.
" " per train	716,560 "
" " percentage on empty cars, average	85.6
" " percentage on loaded cars, average	25.0

In making the terminal test, before starting from the summit, all brakes were examined and found to be operative. The piston travel had been adjusted in accordance with the rules of the company for this heavy service, but two or three brakes leaked off through defective retaining valve pipes.

The train was successfully handled down the severe grade as indicated below, with 5-lb. brake pipe reductions. The grade and speed of the train are as follows:

Maximum grade	190 ft. per mile, or 3.6 per cent.
Minimum grade	173 " " " " 3.3 "
Average grade	175 " " " " 3.4 "
Length of grade	5.5 miles
Running time of train on grade	25 mins.
Average speed of train on grade	13.2 miles per hr.

This was not only the heaviest train that ever went down the mountain, but it had by far the heaviest tonnage per car, or per brake, that had previously been considered practicable to handle with safety.

The following is an interesting comparison:

Tonnage handled with standard brake (assisted by hand-brakes)	1,120
Tonnage handled with "K" valves (no hand brakes)	1,429
Increased tonnage handled per brake, "K" valves	78.75 per cent.
Time consumed on grade with standard valve, assisted by hand brakes	40 mins.
Time consumed on grade, "K" valve (no hand brakes)	25 mins.
Maximum average speed allowed with old brake	8.25 mls. pr hr.
Average speed maintained with "K" valves	13.20
Increased speed with "K" valves, over old practice	61 per cent.

While the tonnage of the test train was 27 per cent. heavier than was considered safe to handle under the old method of braking, and the speed was 61 per cent. higher, it was necessary to use steam in the locomotive cylinders through one or two curves, in order to maintain a desired minimum speed, notwithstanding that the brake pipe reductions were only five pounds. The usual practice of applying the brakes on straight lines and releasing at the entrance to curves was followed, and while on straight track and heaviest part of grade, a 12-lb. application stopped the train from the maximum speed maintained while descending the grade, in a distance of 430 ft.

The light brake pipe reductions and short time brakes were held applied, also made the locomotive and tender brake practically inoperative, thus increasing the work required of the train brakes.

The temperature of the wheels was as nearly uniform at the foot of grade as could be expected, there being a marked absence of cold, or excessively hot wheels, indicating that each brake was doing its share of work, notwithstanding that several brakes leaked off through the retaining pipe. The uniform temperature of wheels at the foot of the grade demonstrated that the retarding feature of the triple valves on the cars with defective retainer pipes performed, in part, the function of retaining valves.

The results of the tests were so thoroughly satisfactory to the railroad officials present at the test, and were considered such a decided improvement over the old method of using hand brakes in conjunction with the air-brakes, that immediate steps were taken to control the speed of the trains on the grade in the future with the air-brakes exclusively. The author of this paper is therefore of the opinion that where cars are equipped with the improved quick service, retarded release, triple valve and "three position" retaining valves, no difficulty should be experienced in successfully handling 100,000 lbs. capacity cars, fully loaded, down approximately 200-ft. grades, provided the brakes are properly maintained and the braking power is, at least, 80 per cent. to 85 per cent. of the light weight of the car.

Cost of Safety Devices on Harriman System.

The following table has been compiled in the office of J. Kruttschnitt, Director of Maintenance and Operation of the Union Pacific System and the Southern Pacific Company. It shows the expenditures for safety devices from June 30, 1898, when the present management took control, to May 1, 1907. These are divided into two groups: one, safety devices on roadway, the other, safety devices on cars and engines. The cost of roadway protection is about $1,000,000 greater. The total cost of such expenditure during this period is nearly $12,000,000. The present operated mileage of the Union Pacific System is 5,404 miles, and of the Southern Pacific Company 9,192 miles. The table of expenditures follows:

Union Pacific System and Southern Pacific Company.
Expenditures June 30, 1898, to April, 1907, for Safety Devices on Roadway, Equipment, Etc.

	Union Pacific.	Oregon Short Line.	Oregon R. & Nav.	Pacific System.	Sunset-Central.	Total.
Block signals	$1,617,109	$354,363	$430,302	$2,232,083	$825,537	$5,459,894
Distant switch signals	169,950	7,630	.....	50,900	18,552	247,032
Interlocking railroad crossings	170,000	32,032	20,845	109,550	234,983	567,410
Crossing bells and gates at highways	12,000	1,734	.....	32,300	6,755	52,789
Total, roadway expenditures	$1,969,059	$395,759	$451,147	$2,424,833	$1,085,826	$6,326,624
Automatic couplers	$270,217	$180,792	$103,403	$988,474	$420,763	$1,963,649
Air brakes and high-speed attachments	527,591	137,846	206,723	1,515,001	909,028	3,296,189
Train signals	8,391	.....	.....	27,982	.....	36,373
Grab irons and hand-holds	37,061	62	.....	.....	.....	37,123
Electric and acetylene headlights	32,979	10,138	10,544	87,075	32,828	173,564
Total equipment expenditures	$876,239	$328,837	$320,676	$2,618,532	$1,362,619	$5,506,896
Total, road and equipment	$2,845,298	$724,596	$771,816	$5,043,365	$2,448,445	$11,835,520

GENERAL NEWS SECTION

NOTES.

A report says that 200 Russian and 1,200 Chinese have been shipped to Mexico to work on the Cananea, Yaqui River & Pacific.

Agents of the Rock Island are giving lectures in eastern Colorado to teach the farmers how to cultivate the land by dry farming.

The Dowling bill, providing for a connecting railroad between the Brooklyn bridge and the Williamsburg bridge, in New York City, passed the Senate May 21.

Two thousand freight handlers on the Buffalo docks are reported to have stopped work on May 20, demanding an increase of wages from 17½ cents to 20 cents an hour.

The headings of the north tube of the Belmont tunnel under 42d street to Long Island City met May 16. It is believed that the south tube will be connected through in August.

W. G. McAdoo, President of the Hudson & Manhattan Railroad Company, is quoted as saying that by October 1 the line from Hoboken to 14th street and Sixth avenue would be in operation.

A press clipping says that the Rock Island sold 100,000 decks of cards on its trains and at stations during the past year, netting a profit of $15,000. The backs of the cards bore the road's advertisement.

It is announced that the rates on canned goods, carloads, from St. Louis to Texas common points, are to be advanced June 17 from 51 to 54 cents, and that the rate of 51 cents will be canceled for the entire year.

Several hundred Italian trainmen employed by the New York, New Haven & Hartford went out on strike, May 20, following the refusal of the road to grant a demand for a 10 per cent. increase in their wages, which are now $1.50 per day.

The Chicago & Milwaukee Electric Railroad has petitioned the Interstate Commerce Commission to compel the Illinois Central to enter into joint traffic agreements covering articles of merchandise and to establish the basis of division of through rates.

The pier occupied by the Southern Pacific's Morgan line of steamships, at the foot of Spring street, New York, was destroyed by fire May 17. The loss is estimated at $500,000. One of the company's ocean steamers and several smaller craft were lying at the pier, but were saved.

The first attempts at turning the current on the new electrical overhead system of the New Haven road between New York and Stamford are reported to have set up induced currents which seriously affected the transmission of messages on the telegraph and telephone wires within 50 ft. of the track.

At time of writing, the New York longshoremen's strike is still unsettled. A few coastwise companies have raised their schedule of wages, but the transatlantic lines are all standing out. Italians are being brought to the docks on steamboats to act as strike-breakers, but have difficulty in doing the work.

The Chicago, Rock Island & Pacific pleaded guilty on May 20 to two of the 12 counts for rebating and was fined $1,000 on each. The indictment charges the road with granting a rebate of 5 cents a hundred pounds on sugar shipped by the Woolson Spice Co., of Toledo, Ohio, to St. Joseph, Kansas City and Atchison.

The Attorney-General of Indiana has given out an opinion to the effect that the new 2-cent railroad passenger fare law does not apply to interurban roads within the state. It is believed that the law may be found unconstitutional, on the ground that it is class legislation, because it includes one kind of common carrier and not another kind.

A bill has been introduced in the Massachusetts legislature to prohibit the merger of transportation companies, and the investment by one transportation company in the stock of another. The petition accompanying the bill says it is designed to prevent the contemplated merger of the New York, New Haven & Hartford and the Boston & Maine.

The engineers and firemen of three trains, two on the New Haven road and one on the Harlem, were arrested at Mount Vernon, N. Y., May 21, for the violation of a city ordinance against the use of soft coal on locomotives in the city limits. To one of the trains there was attached a United States mail car. Each arrest caused a delay and angered the commuters.

The Eleventh avenue bill, providing for a subway for the New York Central's west side freight tracks in New York City between Thirtieth and Sixtieth streets and an elevated structure across Manhattan Valley, cost to be divided between the railroad and the municipality on a basis to be agreed upon by the Board of Estimate and Apportionment and the corporation, passed the New York Senate May 21.

Injunctions have been issued by the United States Circuit Court, Judge Pritchard, restraining the Corporation Commission of Virginia from publishing its order putting the 2-cent passenger rate in effect in that state, and restraining the Corporation Commission, the Attorney-General and the Assistant Attorney-General of North Carolina from publishing and putting into effect the new law providing for a passenger rate of 2¼ cents.

The United States Geological Survey within a few weeks will establish, probably in the Pittsburg district, an experiment station for the purpose of testing explosives used in coal mining, the ultimate object being, if possible, to reduce the number of mine disasters resulting from gas and coal dust explosions. Miners' safety lamps will also be tested at this station, and explosive investigations conducted both in the laboratory and in the mines.

Official figures just compiled show that the Pennsylvania Railroad Company on May 4 had 45,496 shareholders, the largest number in its history and twice as many as it had ten years ago. The average number of shares held is 137. Of the total number of shareholders, 21,028 are women. The company states that the increase in wages granted by the company in the last few months amounts annually to more than the total dividend of $12,262,491 paid in 1902.

Better Rails Needed.

Charles M. Schwab, formerly President of the United States Steel Corporation, says that better rails are becoming absolutely necessary on account of the increasing speed and weight of trains. The open-hearth steel rail, he thinks, will first supplant, to a large extent, the Bessemer rail. He criticises the shape of the present rail, not for its service qualities, but because it is responsible for the composition. The head of the rail is too heavy and the flange too light. The impurities, which cause the breaking of the top of the rail, are due to the fact that it has to be rolled while very hot, for which the heavy top is largely responsible. It is not to the open-hearth rail that the railroads must finally look. Eventually neither railroads nor people will be content with anything short of the very best, which is a nickel or some other alloy steel rail, which will cost something like three times as much as the present rail. In connection with these statements an official of the Carnegie Steel Company at Pittsburg is reported to have declared that on a recent run of the 18-hour Pennsylvania Special between New York and Chicago, 20 rails were broken.

Rate Reductions After Complaint.

A number of cases have within the last few days been announced by the Interstate Commerce Commission in which it was not necessary for the commission to pass judgment on the merits of the original complaints as the railroads in question had made reductions after the filing of the complaints but previous to their decision.

One of these was the case of the National Petroleum Association against the Pennsylvania and a long list of other railroads forming through routes to the Pacific coast. The complainant last October protested against the rates from Ohio and Pennsylvania to the coast on petroleum and its products, and claimed that the charge of $105 each for return of cylinder oil cars from Pacific coast terminals to Missouri river points should be abrogated. It was alleged that the Standard Oil refineries at Whiting, Ind., had an immense advantage in shipments to the coast. The railroads, after the complaint was filed, discontinued the most objectionable practices and changed their rates, so that the complaint is now dismissed, there being no need to hear it.

The alleged unreasonable and discriminatory rates were: From Toledo and Findlay, Ohio, 90½c. per 100 lbs. in tank cars and barrels, carloads; from Cleveland, Ohio, 93c.; Marietta, Ohio, 95½c.; from Pittsburg, Freedom, Oil City, Titusville, Warren and Bradford, Pa., 98c.; these rates being made up of the locals to Chicago applying from the respective points mentioned, plus the through rate of 78½c. from Chicago to Pacific coast destinations.

It was claimed that the rates above shown were in and of themselves unreasonable, and that as compared with the rate of 78½ cents applying from Chicago and common points, including Whiting, Ind., said rates were unjustly discriminatory. Complainant, therefore, asked that this rate of 78½ cents from Chicago and com-

mon points be made to apply from the several cities east of Chicago enumerated.

The railroads filed answers, denying the allegations and the case was assigned for hearing at the office of the commission in Washington May 21, 1907. The defendant carriers, however, since answering, have published tariffs, naming a uniform through rate of 90 cents per 100 lbs. to apply from Chicago and common points, including Whiting, Ind., and also from the several points east of Chicago named in complaint to San Francisco and other Pacific coast points. The charge of $105 for the return of empty tank cars from Pacific coast destinations has also been abolished. In view of the facts and upon request of complainant the case was dismissed without prejudice.

In a second complaint of the National Petroleum Association against the Pennsylvania and various other roads it was alleged that the through rate on petroleum products from Oil City, Pa., to Freeport, Ill., via Chicago, was 25.5 cents per 100 lbs., whereas the combination rate on Chicago was only 23 cents. The carriers in their answers signified willingness to reduce the rate to 23 cents and subsequently put this rate in effect. Therefore the complaint was dismissed.

A third case was that of the Kalamazoo Tank & Silo Co. against the Michigan Central and the Chicago, Milwaukee & St. Paul. The complainant shipped one carload of silos, knocked down, from Kalamazoo, Mich., to Elkhorn, Wis., via Chicago, on which it was charged a joint through rate of 28 cents per 100 lbs., whereas at the same time the carriers' combination rate on Chicago between the same points on the same commodity was only 17 cents; similar improper adjustments in rates between points not given were alleged. After the case was at issue the carriers reduced their joint through rate from Kalamazoo to Elkhorn to 16 cents per 100 lbs., and at the hearing they conceded that the 28-cent rate was excessive to the extent of a difference between that rate and 17 cents, and agreed that improper adjustments in rates between said other points should be corrected. The commission holds that complainant should be awarded reparation on the specific shipment on the basis of such difference in rates, and that as to other matters mentioned in the case the complaint be dismissed.

Still another case was that of the Manufacturers' Club of Terre Haute, Ind., against the Louisville & Nashville and the Big Four. The complaint alleged that rates on coke from Kentucky and Virginia ovens to Terre Haute were unreasonable as compared with rates on coke from such points of origin to Chicago and other specified points. After the complaint was filed the carriers made the rates to Terre Haute the same as those to Chicago. In view of these circumstances the complaint was dismissed.

Railroad Justified in Moving Station.

The Interstate Commerce Commission has announced its decision in the case of Cornelius J. Jones and others against the St. Louis & San Francisco. This complaint arose because the railroad moved its station at Chase, I. Ter., 3½ miles west to a junction point which another road also called Chase. The complainants sought restoration of station facilities at Chase and demanded damages. The conclusions of the Commission are as follows:

> The obligation to provide station facilities at a given point along the line of a railroad may arise under the terms of the charter of a company, or may be imposed by statute, and some authorities assert that the duty exists also at common law; but the Commission is not the proper forum to which to appear for the enforcement either of a charter, statutory or common-law obligation, as it has no authority to issue the writ of mandamus and possesses no common-law jurisdiction.
>
> The contention that the Commission has power, under the Rate Law to require a common carried to locate or relocate and maintain a station at a given point is open to doubt; but, without deciding this question, it is manifest that the Commission should not exercise such power unless all the facts and conditions clearly indicate that the interests of the general public in the locality involved are materially impaired by the lack of such facilities.
>
> The record does not show that the interests of the general public have been materially impaired by the removal of the station to the new point, and under the circumstances named complainants are not entitled to an order requiring defendant to re-erect and maintain a station at old Chase.
>
> The defendant having the lawful right, in the public interest as well as in its own interest, to move its station to the new point, it can not be held liable for damages alleged to have been sustained as a consequence of such action.

Railroad Keeping Pace with Irrigation.

The railroad just finished by the Southern Pacific from Hazen, Nevada, to Fallon, 16½ miles, is a straight line from northwest to southeast across the Truckee irrigation territory. The new road is a branch of the California & Nevada line. At present, with the exception of two miles near Fallon, the road passes through an absolute desert, but the government irrigators will soon turn this territory into a rich agricultural section.

The Truckee project was the first one undertaken by the government under the law of 1902. An ample supply of water will be provided to irrigate 350,000 acres of rich land in western Nevada. It includes the Carson sink country, which, the government experts say, will make exceptionally fertile farming land as soon as water is available. The country around the state capital is also included.

The main feature of the irrigation work is a canal 30 miles long to divert water from Truckee river to the channel of Carson river, where a storage reservoir is to be built. This canal, with several hundred miles of lateral ditches, is already finished and water is ready for delivery to about 50,000 acres, 30,000 of which are public lands open to homestead settlement. When the settlers come they will find the Hazen-Fallon Railroad ready to distribute their products to the surrounding mining districts, which will form the settlers' market. The railroad is already of great service to the irrigation construction forces in transporting supplies and materials.

Virginia Railroads to Resist.

All the railroad companies operating in Virginia have decided to resist in every legal way the orders of the State Corporation Commission fixing a maximum passenger rate and putting into effect a single uniform freight classification. Except for certain branches where the total traffic is light, the passenger rate is made 2 cents a mile for the following roads: the Norfolk & Western, the Chesapeake & Ohio, the Atlantic Coast Line, the Seaboard Air Line, the Southern, the Richmond, Fredericksburg & Potomac, the Washington Southern, the New York, Philadelphia & Norfolk, the Virginia & Southwestern, and the Louisville & Nashville. Twenty-four other roads are allowed to charge from 2½ to 3½ cents per mile. The uniform freight classification, to be known as Virginia Classification No. 1, is ordered into effect July 1 on all of the roads above mentioned, except the Richmond, Fredericksburg & Potomac and the Washington Southern.

In the preliminary hearings before the commission, the railroads raised in their defense not only the usual objections to the constitutionality of the law and the proceedings under it, but also attacked the methods by which the commission sought to determine the profitableness of intrastate as compared with interstate transportation. The commission conceded that it was impossible to ascertain exactly the earnings, expenses and property employed in exclusively Virginia business, but asserted that the testimony submitted by the defendants and facts otherwise brought out enabled the commission to ascertain all those matters "with sufficient practical accuracy for the purposes of this proceeding."

Notwithstanding a mass of testimony submitted by several carriers to show that the cost of conducting intrastate business was materially greater than that of conducting interstate business, the commission decided that such was not the case. The commission strengthened itself in this position with the argument—one likely to amaze the average railroad operating official—that it was the interstate business as distinguished from the bulk of that within state lines, in which the heaviest motive power and rolling stock were employed, necessitating the largest expenditure on roadbed, track and bridges, and entailing the greatest wear and tear on the property. The inference which the commission obviously intends to convey is that railroads employ heavy equipment to the detriment of their own profits, and only because the nature of the traffic compels its use. It is to be hoped that this will not escape the appreciative eye of Mr. James J. Hill.

After reducing to a per mile basis the earnings of the railroads on business in Virginia during 1906, as reported to the commission, the commission reaches the conclusion that the railroads are earning in that state 6 per cent. on the following valuations of their property:

Norfolk & Western	$98,000 a mile.
Chesapeake & Ohio	82,000 "
Atlantic Coast Line	85,000 "
Seaboard Air Line	62,000 "
Southern	45,000 "
Richmond, Fredericksburg & Potomac	127,000 "
Washington & Southern	90,000 "
New York, Philadelphia & Norfolk	85,000 "

In determining a reasonable valuation of the property, the commission entirely discards the amount of bonds and stocks issued and says that the current market value of the securities is too subject to manipulation and depends too much on earning capacity to be a criterion. To fix the future earning capacity by the value of the property and then to ascertain that value by the present earning capacity as reflected in the market value of the securities would be reasoning in a circle. Original cost and cost of reproduction are in many cases impossible to determine.

The commission specifically disavows the theory that the taxable value of railroad property should be the same as its commercial value, but holds that such values should bear some reasonable relation to each other. Finally the commission points out the great familiarity of its own members with the railroad property of the state from their personal inspection of the physical property. The commission justifies itself in availing itself of this personal knowledge as one factor in the determination. But all of the foregoing considerations, the commission declares, entered into their deliberations, their final judgment being a composite result of them all.

By this process the commission has decided that the entire Vir-

ginia property of no railroad company is worth more than $50,000 a mile for the entire mileage in the state, while the property of most such companies is worth less.—*Wall Street Journal.*

Fire Exits in New York Subway.

At 14 points in the New York subway, between City Hall and 59th street, where air chambers have been put in for ventilation, fire exits have been provided which can be used by passengers on subway trains in emergencies. These are marked by large signs lighted by shaded electric lights. A door opens into the air chambers at the side of the local tracks and an iron ladder leads to the top of the pit, which is covered by open gratings. The section of the grating above the ladder can then be lifted up, giving egress to the sidewalk.

Railroads and the Rate Law.

Charles A. Prouty, of the Interstate Commerce Commission, has recently been quoted as follows:

The railroads of the United States are to be complimented on the disposition they have shown to abide by the Rate Law.

Scores of questions have been raised under the new law on which the railroads might have demanded a decision by the courts before obeying the orders of the Commission, or accepting its construction of the law, but in every instance they have promptly and cheerfully co-operated with the Commission. On the other hand, the Commission has tried to avoid imposing unnecessary hardships on the railroads in meeting the new conditions. It is demonstrated beyond doubt that the railroads are in hearty sympathy with the interstate commerce law and that the rebate and kindred evils are practically abolished. The great majority of railroad officials are honest and fair-minded, but they have been living under a cloud raised by few unscrupulous and dishonest men. To-day every railroad official can follow his inclination to treat all shippers alike, without fear that some official of a competing road will secretly pay rebates in one form or another.

The law is designed to protect the railroads as well as their patrons. Railroad managers recognize to-day that it is their greatest protection against extravagant legislation by individual states. Had the railroads always observed the Interstate Commerce law as they do to-day, I believe they would not have had forced on them such a flood of state laws reducing passenger fares to 2 cents a mile, providing for "reciprocal demurrage," and other hostile legislation. Many railroad officials believe now that the authority of the Interstate Commerce Commission will have to be extended to the operation of the railroads, in addition to their traffic, in order to protect them from state laws like those requiring freight cars to be moved not less than a specified number of miles daily, or unjust laws on reciprocal demurrage.

Public Utilities Bill Passed.

The public service commissions Act, commonly known as the Public Utilities Bill, the principal of the reform measures supported by Governor Hughes, passed the New York State Senate on May 22 by a vote of 41 to 6. On May 15, a week earlier, it passed the Assembly by a unanimous vote. After it was passed by the Senate the Assembly unanimously concurred in the Senate's amendments. The passage of the bill in the Senate was hastened by an "emergency message" of the Governor.

Rates on Oil from Kansas to Missouri.

The Interstate Commerce Commission has announced its decision in the case of E. M. Wilhoit v. the Missouri, Kansas & Texas as follows:

At the date of filing complaint the carriers' rate on refined oil from Erie, Kan., to Joplin, Mo., 69 miles, and to St. Louis, Mo., 400 miles, was 17 cents per 100 lbs.; but later the rate from Erie to Joplin was reduced to 15 cents, which is the rate prevailing from other oil-shipping points in Kansas to Joplin. The rates to Joplin, St. Louis and Kansas City from these producing points are apparently adjusted with a view to affording the shippers equal opportunities in the markets. The Commission holds that to make distance the sole factor in determining a reasonable rate would introduce undue discrimination and create chaotic commercial conditions. The complaint is dismissed.

Railroads as Shippers: Astray Shipments.

In its tariff circular, No. 13-A, the Interstate Commerce Commission makes two administrative rulings. The first is that under the law a carrier or a person or corporation operating a railroad or other transportation line, cannot as a shipper over the lines of another carrier be given any preference in the application of tariff rates on interstate shipments. In other words, one carrier shipping its fuel, material, or other supplies over the line of another carrier, must pay the legal tariff rates applicable to the same commodities shipped by an individual. The Commission suggests that there may be some instances, such as the movement of needed fuel, in which, in order to keep the trains or boats moving, such traffic could be given preference in movement without creating unjust or unwarranted discrimination.

The second ruling relates to the return of astray shipments. The Commission is of the opinion that in instances where through error or oversight on the part of some agent or employee the shipment is billed to a wrong destination or is unloaded short of destination or is carried past, carriers may return such astray shipments to their proper destination or route without the assessment of additional charges, and may arrange for such movement of such astray shipments for each other on mutually acceptable terms without the necessity of publishing, posting and filing tariffs under which it will be done.

Meeting of the Burlington Association of Operating Officers.

An account of the organization, history and method of operation of the Burlington Association of Operating Officers, together with something of what it had accomplished, was given in these columns about a year ago (June 6, 1906). As indicated in that article, the objects of these meetings are to promote closer relations between the various departments, to bring about uniformity of standards and practices and to advance the interests of the company in every way.

The 1907 meeting was recently held at the Auditorium Hotel, Chicago. Yearly meetings have been held since 1898. Prior to that time they were semi-annual, the last gathering being the thirty-ninth. The meetings are conducted in much the same way as the Master Mechanics' and Master Car Builders', papers being presented and discussed and the discusson reported verbatim. The proceedings are published in pamphlet form. Recommendations made at the meetings are referred to the management for final approval, after which instructions are issued making them standard practice.

Over 60 subjects were handled at the recent meeting, about one-third of which were unfinished questions from former meetings. There were 33 new subjects, offering a good variety. For example, the question of cross-tie timber, its source and cultivation; ventilation of passenger cars; uses and economy of concrete, and many other phases of railroad work were considered. Several individual papers were presented, one bearing the caption "He Supposed So" being especially interesting. The short, snappy discussion of subjects under the head of topical discussions creates much interest on account of members only being allowed five minutes for each question. During the life of the association something over 1,050 subjects have been handled.

A dinner given in the evening of the second day of the meeting, at which Second Vice-President Willard presided as toastmaster, was greatly enjoyed by the members. The officers for the coming year are: Chairman, H. E. Byram, General Superintendent, Lincoln, Neb.; First Vice-Chairman, A. Forsyth, Superintendent Shops, Aurora, Ill.; Second Vice-Chairman, E. Bignell, Division Superintendent, Lincoln, Neb.; Secretary, S. D. Brown, Chief Clerk to General Superintendent Motive Power, Chicago.

Manufacturing and Business.

The American Steel Foundries have moved their Chicago office from the First National Bank building to the Commercial National Bank building.

Walter D. LaParle, Chicago, heretofore handling a line of railroad supplies, will hereafter devote his entire time to the interests of the Beaver Dam Malleable Iron Co., Beaver Dam, Wis.

The charter of the Davis Pressed Steel Company expired by limitation on May 1, and the Davis Solid Truss Brake Beam Company, Wilmington, Del., is now making the Davis solid truss brake-beams.

At the annual meeting of the General Electric Co., S. L. Schoonmaker and Marsden J. Perry were elected Directors, succeeding Eugene Griffin, deceased, and T. K. Henderson. The other Directors were re-elected. B. E. Sunny and J. R. Lovejoy, Manager of Sales, have been elected also Vice-Presidents.

The American Car & Equipment Co., Chicago, has recently received the following orders: Assumption Coal & Mining Co., Assumption, Ill., 50 gondola cars of 80,000 lbs. capacity; New York, Auburn & Lansing, 50 flat cars; Sioux City Brewing Co., Sioux City, Iowa, 10 refrigerator cars; Stewart & Mathews Co., St. Paul, Minn., one private car.

J. G. Platt, who recently resigned as Master Mechanic of the Franklin works of the American Steel Foundries, Chicago, on account of his health, has been appointed mechanical representative of the Hunt-Spiller Manufacturing Corporation, Boston. Before going to the American Steel Foundries he was for many years Engineer of Tests of the Erie.

Charles C. Mickle, of Philadelphia, has been appointed General Manager of the Trojan Car Coupler Co., with office at New York, succeeding Harvey N. Loomis, retired. The company recently removed its Troy and St. Louis shops to Columbus, Ohio, where all its car couplers are now made. The Chicago office has been removed to 503 Western Union building.

The Pittsburg Automatic Vise & Tool Company have completed all their plans for the exhibiting at the Master Car Builders' and Master Mechanics' convention at Atlantic City, June 13-20, of the largest vise yet built. The tool will be operated by electricity, the double swivel movement being visible at all times. The vise weighs 695 lbs. and has a jaw opening of 15 in.

Silk, McClellan & Co., Chicago, is a new firm in the railroad supply business. In active management are two young men who have had considerable experience in the supply business and many friends in the railroad field. They are making a line of high-grade car specialties. Edward E. Silk has been in the railroad supply business for about seven years. Previous to that time he was with the Central of New Jersey and for two years was Associate Editor of the *American Engineer and Railroad Journal.* He is a graduate of Purdue University, where he took a mechanical engineering course. Benjamin S. McClellan has also been in the supply business for about six years and before that was for eight years in charge of the car shops of the Illinois Central at New Orleans, and for three years in charge of the West Albany passenger car shops of the New York Central. The specialties the firm is making include a line of dust-proof, air-tight window fixtures, special sash locks, desk sash ratchets, universal steam couplers and hose bands. The main office and factory is at Fifty-eighth street and Normal avenue, Chicago. They have complete sets of blue prints and illustrated matter to mail on request.

Iron and Steel.

Bids recently opened by the purchasing agency of the Panama Canal at Washington, D. C., for 5,000 tons of rails delivered at Colon for railroad construction on the Isthmus were: Maryland Steel Company, $158,750, and the United States Steel Products Exporting Company, $162,250.

The Illinois Steel Company has orders for 65,000 tons of rails from the Northern Pacific for 1908 delivery. Other orders include 10,000 tons for the St. Louis & San Francisco, 10,000 tons for the Illinois Central, and 4,000 tons for the Great Northern. It is said that another company has orders for 10,000 tons from the St. Louis & San Francisco. There are inquiries for about 100,000 tons. Orders for Bessemer rails for next year's shipment now aggregate about 370,000 tons and the open hearth orders 220,000 tons for the Tennessee Company and 25,000 tons for the Bethlehem mill, making a total of all kinds for 1908 of 615,000 tons.

OBITUARY NOTICES.

J. B. Winston, formerly and for many years Treasurer of the Richmond, Fredericksburg & Potomac, died on May 20 in Richmond, Va. Mr. Winston was 77 years old.

E. P. Lord, General Manager of the H. K. Porter Company, died recently in Pittsburg. Mr. Lord was born in Massachusetts in 1860, and graduated from Yale University in 1881, afterward taking the post graduate course at Stevens Institute of Technology. He began railroad work on the Pennsylvania, serving at Renova, Pa., and Altoona, and then being made Assistant Superintendent of Motive Power of the Lines West, at Fort Wayne, Ind. In 1892 he went to the Cleveland, Cincinnati, Chicago & St. Louis as Superintendent of Motive Power, but after a year resigned to become Superintendent of the H. K. Porter Company, of which he was later appointed General Manager.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Association of Railway Telegraph Superintendents.

The twenty-sixth annual meeting of this Association is to be held at the Marlborough-Blenheim, Atlantic City, N. J., June 19 and 20, 1907. Hotel accommodation has been arranged for as follows: One person from $4 a day to $8; for two persons occupying double room $8 a day to $12 on the American plan, or from all of the above rates an allowance of $2 a day for each person will be made if the rooms are rented on the European plan.

The Pullman Co. announces that it will extend to delegates attending the convention and dependent members of their families, the same courtesies as heretofore, viz., upon presentation of receipts showing full fare paid to the convention together with proper credentials of the association, to its representative at Atlantic City, passes will be issued for a return trip to delegates attending the convention who are connected with railroads and in active service.

A partial list of the papers to be read follows:

"Education of Telegraphers in Railroad Work," by H. C. Hope.

"The Superintendent of Telegraph, What he is *versus* what he is not," by F. E. Bentley.

"Maintenance and Operation of Telephone Service on Railroad Company's Lines," by S. L. Van Akin, Jr.

"Opportunities in the Telegraph Service," by G. W. Dailey.

"Experiments with Concrete Poles," by G. A. Cellar.

"Visible Supply of Telegraph Poles," by W. W. Ashald.

"Operation and Maintenance of Railway Telegraph Service," by J. C. Browne.

"Wireless Telegraphy," by Wm. Maver, Jr.

"Standard Telegraph Line Construction," by C. H. Bristol and D. R. Davies.

"Dry Batteries," by U. J. Fry.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Erie.—James N. Hill and Ogden Mills have been elected Directors, succeeding James J. Hill and D. O. Mills, resigned. J. N. Hill was elected also a member of the Executive Committee, succeeding Samuel Spencer, deceased.

Lehigh Valley.—J. J. Morrison, Auditor of Disbursements, has been appointed Auditor, and his former office has been abolished.

Operating Officers.

Chicago, Milwaukee & St. Paul.—C. F. Morrison has been appointed Superintendent of the James River division, with office at Aberdeen, S. Dak., succeeding G. G. Mason, resigned.

Chihuahua & Pacific.—H. C. Ferris, Superintendent of the Toledo & Ohio Central, has been appointed General Manager of the Chihuahua & Pacific, succeeding C. L. Graves, who resigned early this month to go into other business.

Mexican International.—W. S. Martin, General Manager, has resigned, effective May 31, to go to another company.

Michigan Central.—See Northern Pacific.

New York, New Haven & Hartford.—John P. Hopson, who was recently appointed Superintendent of the New York division, was born at Wallingford, Conn., in 1852. After a common school education he began railroad work in 1867 at Branford Station, on the Shore Line, now part of the New York, New Haven & Hartford. After serving as station agent at different points until 1882, he went into other work for three years. He then returned as agent at South Norwalk in 1885, and two years later was appointed Superintendent of the New York, Rutland & Montreal, now part of the Rutland Railroad. He resigned the next year, and after doing some special work for the Housatonic Railroad, now merged with the New Haven, he was appointed Superintendent of the New Haven & Derby, now part of the New York, New Haven & Hartford. He was made Superintendent of the Berkshire division when it was formed in 1892, and in 1902 was appointed also Superintendent of the Naugatuck division, where he remained until his recent promotion.

John P. Hopson.

Northern Pacific.—C. M. Levey, Third Vice-President, with office at Tacoma, Wash., has been transferred to St. Paul in charge of maintenance and operation of all the company's lines. H. J. Horn, General Manager, has been made General Manager in charge of maintenance and operation in Montana, North Dakota, Minnesota and Wisconsin, with office at St. Paul. H. S. Nutt, General Superintendent of the Michigan Central, has been appointed General Manager of the Northern Pacific at Tacoma, in charge of maintenance and operation of lines in Washington, Idaho and Oregon.

The new Fargo division consists of the lines from Fargo, N. Dak., to Jamestown, including the Casselton, the Cooperstown and the Fargo & Southwestern branches, this territory having been heretofore a part of the Dakota division. J. H. Raver has been appointed Superintendent of the new division, with office at Fargo.

Toledo & Ohio Central.—See Chihuahua & Pacific.

Trinity & Brazos Valley.—The headquarters of J. M. Lee, Superintendent, have been removed from Fort Worth, Tex., to Teague.

Union Pacific.—T. J. Foley has been appointed Superintendent of Terminals at Omaha.

Versailles & Sedalia.—H. F. Reddig, General Superintendent, has resigned to go to another company.

Traffic Officers.

Chicago & Alton.—T. C. Frew has been appointed General Agent at Pittsburg.

Great Northern.—W. W. Broughton, Freight Traffic Manager, has been appointed General Traffic Manager.

Illinois Central.—A. N. Dale, General Agent at St. Louis, has resigned and his office has been abolished.

New York Central Lines.—B. B. Mitchell, Freight Traffic Manager of the lines east of Buffalo, has been appointed General Freight Traffic Manager of all New York Central lines. Francis LaBau, Assistant Freight Traffic Manager, succeeds Mr. Mitchell. H. D. Carter, General Freight Agent, has been appointed First Assistant Freight Traffic Manager of the lines east. W. S. Kallman, General Freight Agent of the West Shore, has been appointed Second Assistant Freight Traffic Manager of the lines east. I. H. Hubbell, First Assistant General Freight Agent of the N. Y. C. & H. R., has been appointed General Freight Agent of the New York Central & Hudson River and of the West Shore. W. A. Newman, Second Assistant General Freight Agent, succeeds Mr. Hubbell. D. E. Gelatt, Division Freight Agent at New York, succeeds Mr. Newman.

Northern Pacific.—H. N. Kennedy has been appointed General Agent at Spokane, Wash., succeeding G. A. Mitchell, promoted.

Trinity & Brazos Valley.—J. E. Fields, chief clerk in the General Freight Agent's office at Fort Worth, has been appointed Assistant General Freight Agent, with office at Galveston, Tex.

Engineering and Rolling Stock Officers.

Atchison, Topeka & Santa Fe.—J. E. Whiteford, General Foreman at Fort Madison, Iowa, has been appointed General Roundhouse Inspector, with office at Albuquerque, N. Mex. He will have supervision, under the direction of the Superintendent of Motive Power, of all methods and practices in roundhouse work.

Chicago, Burlington & Quincy.—A. C. Adams, Master Mechanic of the Lehigh Valley at Sayre, Pa., has been appointed Master Mechanic of the Alliance division of the Chicago, Burlington & Quincy, with office at Alliance, Neb., succeeding G. M. Reynolds, resigned.

Lehigh Valley.—See Chicago, Burlington & Quincy.

Mexican Central.—M. Parra has been appointed Master Mechanic of the Tampico Terminal division.

New York Central & Hudson River.—C. E. Lindsay, who was recently appointed Engineer of Maintenance of Way of the Electric division, was born in Pihladelphia in 1865. In 1881 he worked as chainman on the Pennsylvania, and then entered the University of Pennsylvania, graduating with a C. E. degree in 1885. For six months afterward he was surveyor for the Philadelphia Board of Underwriters, and then went to the Union Pacific on location and construction work. In the summer of 1886, he went to Cincinnati on construction work for the Pennsylvania Lines West, and two years later was made Assistant Engineer at Fort Wayne, Ind. In 1890 he was appointed Engineer of Maintenance of Way of the Cincinnati division, and in 1898 went to the Southern as Division Engineer of the Washington division. Three years later he went to the New York Central as Division Engineer of the Pennsylvania division, which was then being rebuilt and extended. In 1903 he was transferred to the Mohawk division, where he remained until his recent appointment.

John V. Newbert, who succeeds Mr. Lindsay as Division Engineer of the Mohawk division at Albany, was born in Pennsylvania, and graduated from the Pennsylvania State College in 1899. He immediately began railroad work on the New York Central. He was in the accountant's office at New York, and then in an engineering corps on the River division. He was then made assistant supervisor of track of this division, after which he was transferred to the Western division. After serving as acting supervisor of track at Batavia, N. Y., he was made Assistant Engineer in the office of the Division Engineer at Albany. He then came to New York as Assistant Engineer in the office of the Engineer of Maintenance of Way, and later in the Assistant General Manager's office, where he remained until his recent promotion.

Northern Pacific.—J. D. Koren has been appointed Division Engineer of the Idaho and Pasco divisions, with office at Spokane, Wash., succeeding A. C. Terrell, transferred.

Pennsylvania.—J. C. Glass, Master Mechanic of the Allegheny division, has been appointed Master Mechanic of the Conemaugh division, with office at Verona, Pa. D. E. Cassidy has been appointed Assistant Master Mechanic of the Conemaugh division.

LOCOMOTIVE BUILDING.

The Usina Sao Bento has ordered one locomotive from the Baldwin Locomotive Works.

The Midland Valley has ordered five locomotives from the Baldwin Locomotive Works.

The Sung Ning Railway has ordered one locomotive from the Baldwin Locomotive Works.

The White Pass & Yukon has ordered one locomotive from the Baldwin Locomotive Works.

The Wisconsin Steel Company has ordered one locomotive from the Baldwin Locomotive Works.

Monsieur De Cerjat, France, has ordered two locomotives from the Baldwin Locomotive Works.

The Parana Railway, Brazil, has ordered two locomotives from the Baldwin Locomotive Works.

The Southern Lumber Company has ordered one locomotive from the Baldwin Locomotive Works.

The Detroit, Toledo & Ironton has ordered four locomotives from the American Locomotive Company.

The Coudersport & Port Allegheny has ordered one locomotive from the Baldwin Locomotive Works.

The Mahoning Ore & Steel Company has ordered two locomotives from the Baldwin Locomotive Works.

The National Tube Company, Pittsburg, has ordered one locomotive from the Baldwin Locomotive Works.

The Charlestown & Western Carolina has ordered four locomotives from the Baldwin Locomotive Works.

The Indiana Steel Company, Chicago, has ordered 12 switching locomotives from the H. K. Porter Company.

The Cincinnati, Georgetown & Portsmouth has ordered one locomotive from the Baldwin Locomotive Works.

The Colombian Trading Company, 12 Broadway, is in the market for narrow gage locomotives for Colombian lines.

The Anglo Newfoundland Development Company has ordered one locomotive from the Baldwin Locomotive Works.

The La Dicha & Pacific has ordered three locomotives from the Atlantic Equipment Co. (American Locomotive Co.).

The Solvay Process Company, Syracuse, N. Y., has ordered one locomotive from the American Locomotive Company.

The Long-Bell Lumber Company, Kansas City, Mo., has ordered two locomotives from the Baldwin Locomotive Works.

The Portland Railway, Light & Power Company, Portland, Ore., has ordered two locomotives from the American Locomotive Company.

The New South Wales Government Railways are getting prices from the Baldwin Locomotive Works on 30 freight, 15 passenger and five tank locomotives.

The Nevada Northern, which is controlled by the American Smelting & Refining Company, has ordered two locomotives from the American Locomotive Co.

Albert Zucker, an engineer and contractor of Buenos Ayres, is in the market for locomotives for Argentine railroads. His temporary headquarters are at the offices of the United States Steel Products Export Co., Battery Park building, New York.

The Cauca Railroad, which is being built in Colombia by the Colombian Pacific Railroad, has been figuring on two 3-ft. gage consolidation locomotives. E. H. Mason is President and General Manager.

The Copper River & Northwestern, now building in Alaska, is reported to have ordered six saddle-tank locomotives for construction work from the Atlantic Equipment Co. (American Locomotive Co.), and to be contemplating the purchase of other new equipment. M. K. Rogers, President and General Manager, Seattle, Wash.

The Idaho & Washington Northern has ordered two 75-ton, simple, 10-wheel locomotives, with cylinders 19 in. x 26 in., and two 100-ton, simple, consolidation locomotives, with cylinders 22 in. x 28 in., from the Baldwin Locomotive Works, for August and October delivery, and two 75-ton Shay geared locomotives from the Lima Locomotive & Machine Company.

The Duluth, South Shore & Atlantic, as reported in the *Railroad Gazette* of May 10, has ordered six simple consolidation (2-8-0) loco-

motives and three 10-wheel (4-6-0) locomotives from the Baldwin Locomotive Works. The specifications are as follows:

General Dimensions.

Types of locomotives	Consolidation.	Ten-wheel.
Weight, total	172,000 lbs.	145,000 lbs.
Weight on drivers	152,000 lbs.	112,000 lbs.
Diameter of drivers	55 in.	64 in.
Cylinders	20 in. x 28 in.	19 in. x 26 in.
Boiler, type	Straight top; radial stayed.	Extended wagon top.
" working stm. press.	190 lbs.	
" number of tubes	339	320
" diameter of tubes	2 in.	
" length of tubes	14 ft. 6 in.	13 ft.
Firebox, length	96 in.	102 in.
" width	60 in.	40 in.
" material	Worth steel.	
Heating surface, total	2,700 sq. ft.	2,300 sq. ft.
Tank capacity	5,500 gals.	5,000 gals.
Coal capacity	10 tons.	9 tons.

Special Equipment.

Couplers	Gould
Injector	Ohio
Piston rod packings	U. S. metallic
Valve rod packings	U. S. metallic
Safety valve	Consolidated
Sanding devices	Leach
Sight-feed lubricators	Michigan
Springs	Railway Steel Spring Co.
Tires, driving wheel	Latrobe
Tires, truck wheel	Latrobe
Tires, tender wheel	Latrobe
Other specialties	Johnston blow-off cocks

The Central of Brazil has ordered from the American Locomotive Company, for October, 1907, delivery, three Mallet compound, 5-ft. 3-in. gage locomotives. They will have Westinghouse air-brakes.

General Dimensions.

Type	Mallet Compound
Weight on drivers	208,000 lbs.
Total weight	208,000 "
Tractive effort	42,500 "
Diameter of cylinders	17½ and 28 in.
Stroke of pistons	26 in.
Diameter of drivers	50½ "
Rigid wheel base	9 ft.
Total wheel base	27 ft. 8 in.
Boiler, type	Straight top
" diameter	64¼ in.
" working steam pressure	200 lbs.
" heating surface, total	2,350 sq. ft.
Tubes, diameter	2 in.
" length	18 ft.
Firebox length	90⅛ in.
" width	65¼ "
Grate area	40 ft.
Tank capacity	4,500 gals.
Coal capacity	8½ tons

CAR BUILDING.

The Houston Electric Co. has ordered 10 cars.

The Canton-Hankow Railway is in the market for 40 flat cars.

The Sherman & Dallas Interurban Electric has ordered 15 cars.

The Union Pacific is reported in the market for three dining cars.

Capt. L. Johnson, Waycross, Ga., is inquiring for a standard gage gasolene motor car.

The Tramway Rural, Buenos Ayres, is reported to be in the market for 75 electric cars.

The Richmond, Fredericksburg & Potomac is said to be figuring on several steel coal and box cars.

The New South Wales Government Railways are expected to be in the market shortly for several cars.

The Colombian Trading Company, 12 Broadway, is in the market for narrow gage cars for Colombian lines.

The Aurora, Elgin & Chicago has ordered two interurban motor cars from the Hicks Locomotive & Car Works.

The La Dicha & Pacific has ordered several cars from the Atlantic Equipment Co. (American Locomotive Co.).

The Bolivia Railway, in which Speyer & Co. are interested, will shortly be in the market for several gondola cars.

The Midland Valley is reported to have ordered 500 coal cars and 250 box cars from the Mount Vernon Car Mfg. Company.

The Manistee & Northeastern is in the market for 50 flat cars of 80,000 lbs. capacity and 25 flat cars of 60,000 lbs. capacity.

The Solvay Process Company, Syracuse, N. Y., has ordered six Hart convertible cars from the Rodger Ballast Car Company.

The Atchison, Topeka & Santa Fe has ordered 250 tank cars of 10,500 gallons capacity from the Pressed Steel Car Company.

Hegeler Brothers have ordered 15 tank car underframes mounted on 80,000-lb. capacity trucks from the Bettendorf Axle Company.

The Dairy Shippers' Despatch, Chicago, is figuring on 50 refrigerator cars. This company intends to buy a total of 200 new cars.

The Atlanta, Birmingham & Atlantic, it is reported, is about to place orders for 1,000 coal cars, 500 flat cars, 200 box cars and 30 cabooses.

The New York & Queens County (Electric) is reported to have ordered 40 steel passenger cars from the American Car & Foundry Company.

The Standard Equipment Company, Pittsburg, has ordered five Hart convertible cars of 80,000 lbs. capacity from the Rodger Ballast Car Company.

The General Chemical Company, New York, has ordered 10 tank cars of 200 gallons capacity mounted on 100,000-lb. capacity trucks from the Bettendorf Axle Company.

The Nevada Northern, which is controlled by the American Smelting & Refining Co., has ordered 50 gondola cars of 100,000 lbs. capacity from the National Dump Car Co.

The Solvay Process Company, Syracuse, N. Y., has ordered 25 tank cars of 10,000 gallons capacity mounted on 100,000-lb. capacity trucks from the Bettendorf Axle Company.

The Copper River & Northwestern, now building in Alaska, is reported to have ordered fifty 36-ft. dump cars, thirty-four 18-ft. dump cars and six flat cars of 60,000 lbs. capacity. M. K. Rogers, President, Seattle, Wash.

Albert Zucker, an engineer and contractor of Buenos Ayres, is in the market for cars for Argentine railroads. His temporary headquarters are at the offices of the United States Steel Products Export Co., Battery Park building, New York.

The Chilian Government Railways Administration is expected to be in the market shortly for several passenger and freight cars. The contracts will be placed through Wessel, Duval & Co., D. R. Grace & Co., or some other New York export house.

The Louisiana Railway & Navigation Company, as reported in the *Railroad Gazette* of May 10, has ordered 400 wooden box cars of 60,000 lbs. capacity from the Western Steel Car & Foundry Company. The dimensions for these cars were published in the *Railroad Gazette* of May 10.

The Idaho & Washington Northern, as reported in the *Railroad Gazette* of May 10, has ordered three 70-ft. standard passenger cars, one 60-ft. Pullman standard baggage car, and one 60-ft. Pullman standard express car from the Pullman Company; 100 41-ft. flat and 25 40-ft. box cars, both of 80,000 lbs. capacity, from Haskell & Barker, for May and June delivery; 25 40-ft. steel cars of 100,000 lbs. capacity from the Ralston Steel Car Company. The special equipment for passenger, baggage and express cars includes:

Draft rigging	Westinghouse
Trucks	Pullman
Wheels	Page

RAILROAD STRUCTURES.

Brandon, Man.—The Canadian Pacific, it is said, has given a contract to Kelly Bros., of Winnipeg, for putting up a machine shop here to cost $20,000.

Galveston, Tex.—The Galveston Terminal Company has given a contract to James Taylor, of Fort Worth, for a new freight house and warehouse. Work is to be started at once and is to be finished by September 5.

Harmarville, Pa.—Plans, it is said, are being made by the Pennsylvania for building a stone arch bridge on the Conemaugh division at this place to replace the structure carried away by floods. The new bridge will cost about $50,000.

Lima, Ohio.—The Schoepf Syndicate, which controls the Indiana, Columbus & Eastern Traction Company, is reported to have secured a site for a union station to cost $150,000.

New Orleans, La.—A contract for putting up the new union passenger station and train shed at Canal and Basin streets, to cost $500,000, has been let to James Stewart, of New York.

New York, N. Y.—The Board of Aldermen has passed a resolution appropriating $1,600,000 for building a new bridge over the Harlem river at Madison avenue.

Portage la Prairie, Man.—Plans, it is said, have been made for a passenger station to be used by the Grand Trunk Pacific and the Midland (Great Northern). The station is to be 33 ft. x 176 ft., and will cost $30,000.

Rensselaer, N. Y.—A report will soon be made by the Rensselaer Chamber of Commerce on the proposition to build a viaduct over the New York Central and Boston & Albany tracks at Third avenue.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atlantic Northern & Southern.—Local reports state that this company, projected to build a line from Kimballton, Iowa, south to Atlantic, is to be financed by the Palmer Engineering Company

of Kansas City, and work is to be started shortly. J. W. Cuykendall is President, and J. E. Bruce is a Director. (Mar. 15, p. 380.)

BALTIMORE & OHIO SOUTHWESTERN.—This company is building a new 600-car yard at Oakley, a suburb of Cincinnati, Ohio.

BATON ROUGE, HAMMOND & EASTERN.—Contract for building this proposed line from Baton Rouge, La., east, it is said, has been let to John Scott & Sons, of St. Louis. Work is to begin immediately between Baton Rouge and Hammond, and steel for the bridges has been ordered, and the entire right of way from Baton Rouge to Hammond has been cleared. (April 26, p. 598.)

BESSEMER & LAKE ERIE.—An officer writes respecting the proposed extension of the Western Allegheny, that a line has been located from Kaylor, Pa., northeast to a connection with the Franklin & Clearfield at Reidsburg, but that nothing further has been done. (May 3, p. 631.)

CANADIAN PACIFIC.—This company, it is said, is planning to make improvements to reduce the grade at the "Big Hill" between Field, B. C., and Hector, the steepest rise on the whole line. The change will cost about $500,000, and involves the cutting of two long curving tunnels, one on each side of the Kicking Horse river, and putting up three bridges. The grade on this seven-mile section will be reduced from 4½ per cent. to 2¼ per cent. It is expected that this work will be commenced during the early summer, and contracts asked for within a few weeks.

Necessary right of way, it is said, has been secured for the proposed branch line from New Westminster, B. C., to Eburne, and bids for the work will be called for immediately. The line, which will be 9½ miles long, is to be finished and ready for operation by October.

FREDERICKSBURG TERMINAL.—Under this name a company is being organized to build a line from Fredericksburg, Tex., south to a connection with the San Antonio & Aransas Pass, 24 miles. It is proposed to use 17 miles of an old grade. T. D. Smith, Fredericksburg, Tex., is interested.

FRIO VALLEY.—Incorporated in Texas with $125,000 capital to build a line from a point on the Southern Pacific between Sabinal and Yucca northwest to Leakey, about 40 miles. General offices at Leakey. The incorporators include: E. E. Wolf, M. Wolf, G. G. Pryor, W. E. Bradway and Sidney Rosenthal, all of Chicago, Ill.; R. Carrillo, of New York; E. M. Tillman and A. J. Ball, of Dallas; S. H. Weis and M. L. Oppenheimer, of San Antonio.

GRAND TRUNK PACIFIC.—Work has been started in New Brunswick, on Division five, between Edmundson and the Quebec boundary. Lyons & White, who have the contract for this section, have sublet the work in small sections.

J. D. MacArthur, of Winnipeg, who has the contract for work on this road from Winnipeg east to Peninsula Crossing, 245 miles, has sublet 25 miles to the Eastern Construction Company, of Ottawa.

GREENVILLE & KNOXVILLE.—An officer writes that this company is building with its own forces a line from Greenville, S. C., north via Travellers Rest, Marietta, River View, River Falls and Flat Rock to Hendersonville, N. C., 56 miles. About 19 miles graded and 14 miles of track laid to Marietta. Contracts for part of the work are to be let about July 1. Forty miles of the road will be through the Blue Ridge mountains. There are to be two steel bridges, two steel viaducts and four short tunnels. W. D. Patterson, President, Atlanta, Ga., and J. N. Johnston, Chief Engineer, Travellers Rest, S. C.

HOBOKEN MANUFACTURERS' RAILROAD.—This company was recently incorporated in New Jersey with $800,000 capital to build a line paralleling the Jersey Junction and the branch lines of the Erie and West Shore, connecting with the Delaware, Lackawanna & Western on the south, and extending north to the tracks of the Hoboken Shore Railroad near Willow avenue and Fifteenth street, Hoboken. The Shore road skirts the water front of Hoboken from Fifth street north, and furnishes railroad facilities for the steamship company. This road has been leased by the Hoboken Manufacturers' Railroad.

ILLINOIS & FOX RIVER CENTRAL.—Incorporated in Illinois with $50,000 capital and office at Chicago, to build a line from Chicago through Cooke, Will, Grundy and La Salle counties to Ottawa. The incorporators include: William N. Makutcheon, N. Luster, N. Gulano, J. F. Gearon and J. F. Hope, all of Chicago.

ILWACO RAILROAD.—See Oregon Railroad & Navigation Co.

LAWTON, WICHITA FALLS & NORTHWESTERN.—This company, which has projected a line from Lawton, Okla., south to Wichita Falls, Tex., 49 miles, it is said has surveys made, rights of way secured and the necessary capital for carrying out the work. Contracts are to be let in August. A. J. Robinson, Chief Engineer, Frederick, Okla.

LORAIN & WEST VIRGINIA.—See Wabash.

LOUISVILLE & NASHVILLE.—See Morganfield & Atlanta.

MEMPHIS & GULF.—This company, which filed its charter in 1903, has recently been incorporated in Mississippi with $10,800,000 capital to build a line from Memphis, Tenn., south via Meridian, Miss., thence to the Gulf of Mexico, 350 miles. The incorporators include: H. B. Cornell, A. S. Lyman and C. P. Blair, of New York; L. H. Moen, Newark, N. J., and C. H. Pond, Moorhead, Mass. C. H. Pond is President, and R. B. Sims, Treasurer.

MEXICO, SANTA FE & PERRY TRACTION.—An officer writes that contracts are to be let next month for building this proposed electric line from Mexico, Mo., northeast via Molino and Santa Fe to Perry, 27 miles. The work will include two steel bridges and three trestles. S. L. Robison, President, Mexico, and C. O. Thon, Chief Engineer, Brileville. (May 10, p. 663.)

MORGANFIELD & ATLANTA.—This company, it is said, completed its line from Morganfield, Ky., south to Providence, 28 miles. This is reported to be a Louisville & Nashville project. (March 17, p. 387.)

NEVADA ROADS.—A bill has been passed, authorizing W. P. Jennings, of Salt Lake City; H. E. George and H. Gently, of St. Thomas, Nev., to build a line from Moapa, Nev., on the San Pedro, Los Angeles & Salt Lake to the Grand Gulch mining district, 150 miles. It is planned to build 25 miles this year.

NEW YORK CITY TUNNELS.—A junction of the two sections of the north tube of the Belmont tunnel from Forty-second street, Manhattan, with the one from Long Island City was made on May 16. According to the plans this is to be finished and ready for the operation of trains by the New York & Long Island about August 1. It will probably be about two months before connection is made in the second or southeast tunnel. Mr. Belmont and associates secured the tunnel rights and franchise from the Steinway syndicate, which began work in February, 1904, and was suspended and taken up by the new owners early in 1905.

NEW YORK SUBWAYS.—Bids are wanted June 13 by the Board of Rapid Transit Railroad Commissioners, 320 Broadway, New York, for building sections of route No. 9 as follows: From a line crossing Centre street about 40 ft. north of Pearl street, and the southeasterly side of Park Row. This work will consist principally of an underground railroad station, together with the tracks running through it and extending for short distances north and south. Suitable cross-overs, turn-outs and sidings are also to be provided. The tunnels are to have a height of not less than 13 ft. in the clear, and a maximum width of 15 ft. for each track, except at curves, etc. Separate bids are asked for the construction of pipe galleries on the west side of Centre street.

For the section in Delancey street, between the Bowery and Norfolk street, and separate bids for the pipe galleries through Delancey street.

For the section from the north side of Broome street and curving through Cleveland place (formerly Marion street) and private property into the new Delancey street extension, and thence under said extension and under and across the Bowery, and under Delancey street to a point about 225 ft. east of the center line of the Bowery. Separate bids wanted for the pipe galleries through Delancey street and the new extension.

OREGON RAILROAD & NAVIGATION CO.—The Ilwaco Railroad Company has asked for incorporation in the state of Washington. The new company is to have a capital of $350,000, and is being formed as a reorganization of the Ilwaco Railway & Navigation Company, which extends from Baker's Bay, at the mouth of the Columbia river, north along North Beach to Nahcotta, on Shoalwater bay, 16 miles. The new corporation will take over the property of the I. R. & N., including the new line under construction, from Ilwaco east up the Columbia via Cook's Landing to Knappton. The incorporators are William Crooks, R. Blaisdell and H. F. Connor.

OWENSBORO & ROCKPORT TERMINAL & BRIDGE COMPANY.—This company, recently organized to build from Owensboro, Ky., north to Northport, Ind., 12 miles, including a bridge over the Ohio river, it is said, will let contracts early this fall for the work. (Mar. 29, p. 468.)

PENINSULAR (ELECTRIC).—An officer writes that contracts were to be let early this month and work is to be started shortly on an electric line from Bartow, Fla., west via Mulberry, Plant City, Collinstown and Thonotosassa to Tampa, 50 miles. E. C. Stuart, President, Bartow, Fla., and the Evers Engineering Company, Cleveland, Ohio, Engineers. (Apr. 26, p. 599.)

PENNSYLVANIA LINES WEST.—The double-track work on the Pittsburg, Cincinnati, Chicago & St. Louis between Columbus, Ohio, and Bradford Junction, 83 miles, is nearing completion. In April, 1905, this work was started from Woodstock, to which point double track had been laid, west to Urbana, about 15 miles. This section required about 305,000 yds. of grading and 5,600 yds. of masonry construction, and involved the reduction of the grade from 0.9 per cent. to 0.7 per cent. At Woodstock the tracks were raised and grade crossings eliminated. East of Urbana two important road

crossings were eliminated, the streets being built under the tracks. New freight and passenger facilities were added at Covington. Work on the double-tracking from Urbana to St. Paris is still under way. The grading on this section amounts to 1,000,000 yds., and the masonry 11,100 yds. The grade on Blue Hill, west of the Mad river, has been reduced from 1.1 per cent. to 0.7 per cent., and more than one-third of the grading is finished and nearly three-quarters of the masonry. From St. Paris to Jordans, beside the second track work, an eastbound freight track has been laid, involving 196,000 yds. of grading and 5,100 yds. of masonry. The maximum eastbound grade has been cut down from 0.85 per cent. to 0.7 per cent. This finishes the double-tracking except through Piqua, where the tracks occupy a street.

PITTSBURG, CINCINNATI, CHICAGO & ST. LOUIS.—See Pennsylvania Lines West.

RIVERSIDE & GULF.—Incorporated in Texas with $50,000 capital and office at Milvid in Liberty County. The company is planning to build a line from Wallisville, Chambers County, north to Liberty and Polk counties to a point on the Trinity river, about 50 miles. The incorporators include: E. H. Green, Jr., and W. H. Brown, of Beaumont; C. S. Vidor, A. W. Miller, C. H. Moore, B. I. Sparks, R. E. Meese, B. Moore, K. Moore and M. R. Zincke, of Galveston.

SARATOGA & ENCAMPMENT.—This company, which is building a line from Walcott, Wyo., south to Encampment, 45 miles, has started track-laying from Walcott to Saratoga, 25 miles, and expects to soon have trains running over this section. Grading work under way between Saratoga and Encampment.

SAVANNAH & SOUTHWESTERN.—An officer writes that contracts will shortly be let for building this proposed line from Clyde, Ga., via Glenville, Boxley, Douglas, Moultrie and Cairo, Ga., and Quincy, Fla., Bristol and Blountstowe to St. Andrews Bay, about 350 miles. There are to be two steel bridges, each 100 ft. long. Harvey Granger, President, and D. B. Dunn, Chief Engineer, Savannah, Ga. (May 17, p. 695.)

SOUTH & WESTERN.—Contract is reported let by this company to the MacArthur Construction Company, for building an extension from Alta Pass, N. C., south to Marion, 30 miles. The work on this section will be the heaviest on its proposed extension south, necessitating the piercing of about 18 tunnels.

TOLEDO & OHIO CENTRAL.—Plans, it is said, are being made to extend the line from St. Mary's, Ohio, west to Celina, 10 miles. The line, if built, will parallel the Lake Erie & Western.

WABASH.—On the extension building under the name of the Lorain & West Virginia, from Wellington, Ohio, north to Lorain, about 35 miles, tracklaying has been finished and ballasting work is now under way. Of this, 15 miles were finished last year. It is expected to have the line in operation about July 1.

WESTERN ALLEGHENY.—See Bessemer & Lake Erie.

WICHITA FALLS & NORTHWESTERN.—This projected line from Wichita Falls, Tex., northwest to Mangum, Okla., about 90 miles, an officer writes, has been finished from Wichita west for 20 miles. The work includes a 4,200-ft. trestle over the Red river. J. A. Kemp, President, and J. W. Field, Chief Engineer, Wichita Falls.

RAILROAD CORPORATION NEWS.

AUGUSTA, WINTHROP & GARDINER STREET RAILWAY.—See Lewiston, Augusta & Waterville Street Railway.

BROOKLYN RAPID TRANSIT.—Meetings of the stockholders of the Brooklyn Union Elevated have been called for June 10, to approve a mortgage for $20,000,000, and of the stockholders of the Nassau Electric for June 11, to approve a mortgage for $5,000,000. The bonds to be issued under these mortgages are to refund the Brooklyn Rapid Transit, of which these companies are subsidiaries, for advances made and hereafter to be made by the parent company for the improvement of the smaller companies. The New York State Railroad Commission has recently consented to mortgages by the South Brooklyn for $4,000,000, the Canarsie Railroad for $2,000,000 and the Sea Beach Railway for $2,000,000, all these companies being subsidaries of the B. R. T., and the mortgages being made for the same reasons as those of the Brooklyn Union Elevated and the Nassau Electric.

CANADIAN NORTHERN.—This company has acquired a controlling interest in the $4,300,000 capital stock of the Quebec & Lake St. John, which runs from Quebec to Roberval, on Lake St. John, 189 miles, with a branch from Chambord, near Roberval, northeast 51 miles to Chicoutimi, at the head of navigation on the Saguenay river. It connects with the Canadian Northern at Riviere a Pierre Junction, 57 miles from Quebec. A branch from La Tuque Junction to La Tuque Falls, 40 miles, has just been finished and surveys have been made under the name of a subsidiary company for an extension from Roberval to Chute a L'Ours, 30 miles. The principal traffic is lumber.

CHICAGO GREAT WESTERN.—Application has been made to the New York Stock Exchange to list $2,000,000 additional 4 per cent. debenture stock, of which there is $26,127,089 outstanding.

CHICAGO, MILWAUKEE & ST. PAUL.—In an interview at Aberdeen, S. Dak., last Saturday, President Earling said that trains would be running over the St. Paul's Pacific extension as far as Butte, Mont., by next January. The extension, which is under way from Glenham, S. Dak., west, is being pushed with all possible speed.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—This company has sold to a syndicate headed by Moffat & White and J. & W. Seligman & Co., New York, $5,000,000 four-year, 5 per cent. notes, dated June 1, 1907. They are being offered to the public, for delivery on that date, at 96½ and accrued interest. The proceeds are for improvements.

DELAWARE & HUDSON.—This company has sold to Kuhn, Loeb & Co., J. P. Morgan & Co., and the First National Bank of New York, $10,000,000 equipment trust bonds. Though they are secured on new equipment, the whole principal matures in 15 years, instead of in installments.

ERIE.—This company has borrowed $5,000,000 from J. P. Morgan & Co., giving for it one-year notes. The terms are similar to those of the $5,500,000 borrowed from the same firm early in April, except that, it is said, the new money will not cost the railroad company so much as before. (April 12, p. 532.)

GRAND TRUNK.—See Wabash.

HOCKING VALLEY.—See Kanawha & Michigan.

INTERBOROUGH-METROPOLITAN.—The directors have authorized an issue of $15,000,000 collateral trust, 5 per cent., three year notes, which, it is understood, are not to be issued until market conditions are more favorable. The notes are to be secured on $8,000,000 Metropolitan Street Railway notes and blocks of the stock of subsidiaries of the Metropolitan Street Railway. It is stated that the Interborough-Metropolitan has sold about $3,000,000 6 per cent., six months notes to provide mostly for construction.

JACKSON CONSOLIDATED TRACTION.—See Michigan United Railways.

KANAWHA & MICHIGAN.—A meeting of the stockholders has been called for June 4, to authorize an issue of $2,500,000 second mortgage, 20 year, 5 per cent. bonds redeemable at par and interest on any interest day. Most of the proceeds will be used to pay off $2,241,000 floating debt. The Hocking Valley, which controls the road and holds most of the notes constituting part of the floating debt, is to buy half of the new bonds and a syndicate is to be formed to take the remainder. It is stated that this refunding plan will allow of the beginning of dividend payments on the $9,000,000 outstanding K. & M. capital stock, so that a semi-annual dividend of 1 per cent. may be declared on July 1. The merger of the Kanawha & Michigan and the Hocking Valley has been under consideration since last summer. A few months ago it was announced that a refunding plan had been agreed on to be operative only in case the consolidation with the Hocking Valley did not go through. (March 8, p. 322.)

KANSAS CITY SOUTHERN.—It is said that the Chairman of the Board will propose to the Board of Directors that half of the net income after charges be distributed as dividends. An initial dividend of 4 per cent. was declared on the $21,000,000 preferred stock on April 3, 1907, and if distributions be made as suggested above, a dividend of about 2 per cent. on the $30,000,000 common stock could be paid out of earnings for the current fiscal year.

LEWISTON, AUGUSTA & WATERVILLE STREET RAILWAY.—Under this name the Lewiston, Brunswick & Bath Street Railway and the Augusta, Winthrop & Gardiner Street Railway have been consolidated. The roads have 90 miles of line in and near Augusta and between Auburn and Bath. About 60 miles of connecting roads will be built.

LEWISTON, BRUNSWICK & BATH STREET RAILWAY.—See Lewiston, Augusta & Waterville Street Railway.

MICHIGAN UNITED (ELECTRIC).—This company is negotiating for most of the $1,000,000 capital stock of the Jackson Consolidated Traction Company, which owns and operates 30 miles of street and interurban lines in and near Jackson, Mich. The smaller company is to be merged with the Michigan United, giving the last named company in all about 185 miles of road.

QUEBEC & LAKE ST. JOHN.—See Canadian Northern.

WABASH.—According to press despatches from Detroit, this company has finished arrangements to buy the Grand Trunk's line from Niagara Falls, Ont., via Welland Junction, to Windsor, 226 miles. The Wabash has had trackage rights over this line for some years.